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AN  
ELEMENTARY TREATISE  
ON  
ANATOMY.

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&c, &c., &c.

TRANSLATED FROM THE 4TH EDITION OF THE FRENCH.

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## ATOR'S PREFACE.

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THE chief merits of the "ELEMENTARY TREATISE ON ANATOMY," a translation of which is now offered to the medical student, are, great accuracy and conciseness of description, combined with a happy arrangement of the subject. These advantages have secured for the original an extensive patronage abroad; and we hope that the little work will be found, on examination, to deserve an equal success in America. The size of the present volume adapts it admirably for the lecture-room and anatomical theatre; but, although intended more particularly for the medical student, the practitioner will find it useful as a book of reference, as the brief descriptions of the parts of the human body here given will aid him in bringing to mind the more minute details presented in many large works on descriptive anatomy.

In our translation we have recurred frequently to Dr. Bennett's version of the first edition of Bayle.

New-York, Dec. 5, 1836, }  
232 Grand-st. }



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AN  
ELEMENTARY TREATISE  
ON  
ANATOMY.

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PRELIMINARY REMARKS.

ANATOMY is a natural science, which has for its object a knowledge of all the parts of the body. It is divided into *General Anatomy* and *Descriptive Anatomy*.

The object of GENERAL ANATOMY is to describe the simple and elementary tissues, which, by their varied combinations, form all the organs of the body, and also the *fluids* or *humours* which are diffused through the solids.

DESCRIPTIVE ANATOMY treats of each organ in detail, and teaches the apparent or hidden physical properties, the form, number, situation, connexions, relations, and intimate structure of the different organs.

The term *tissue* is applied to every elementary organic part which enters into the composition of the body. The tissues are composed of fibres of different natures, and combined in different modes. The term *system* is applied to them when they are studied generally, and independently of the organs formed by them.

An *organ* is a compound of elementary tissues; it possesses a peculiar action, is designed for a special

purpose, and contributes with other organs to a similar end, to an unique function.

The series of organs which are designed for the same purpose is termed an apparatus.

---

## GENERAL ANATOMY ;

OR, A DESCRIPTION OF THE FLUIDS, TISSUES,  
AND ORGANIC SYSTEMS.

### OF THE FLUIDS.

THE fluids or humours are enclosed in the solids : the quantity of fluids varies in different organs. Some authors say that the proportion of the fluids to the solids is as 6 : 1, others as 9 : 1.

The animal fluids may be referred to three kinds ; 1. The *blood*, which is the aliment and the reservoir of the other humours ; 2. The fluids which enter the blood ; 3. Those the materials of which are found in the blood.

1. *Of the Blood.* The blood is a red, viscid, and slightly saltish fluid, having an odour *sui generis* ; it is contained in the heart and bloodvessels. If examined by the microscope when moving in its canals, it appears formed of a serous fluid, in which red lenticular particles swim. On losing its vitality, the blood becomes cold, gives off carbonic acid gas, and coagulates. It soon divides into two parts ; a solid, termed the *coagulum* ; and a liquid, the *serum*.

On washing the *coagulum*, it also separates into two parts, one of which is the red colouring matter of the blood, which remains suspended in the water ; the other is solid, consistent, whitish, and forms the fibrinous part of the blood. This *fibrin* resembles, in many respects, the fibrin of the muscles : when examined by the microscope it appears similar to the latter, and presents white globules analogous to those

of the colouring portion. The fibrin is composed of tenacious, elastic, and whitish fibres.

The serum is liquid, of a greenish-yellow teint, having the same smell and taste as blood. It is alkaline, and coagulates at  $69^{\circ}$  centigrade. It contains water, albumen, soda, and the salts of soda.

In man, the blood is submitted to the impulse of the heart, which, with some other motive powers, causes it to circulate continually in the cavities of this organ, in the arteries, and in the veins. In the current of the circulation, the nature and composition of the blood are continually changing, and thus the different organs of the body are nourished. The blood is renewed by the chyle received from the thoracic duct, which opens into the left subclavian vein; it receives, also, the results of all the absorptions; it becomes revived by the act of respiration, by which act it loses considerable serum and carbon, absorbs oxygen, and passes from a reddish-brown colour to a vermilion red. Thus changed, it becomes the aliment of all the secretions, and the vital principle of all the tissues with which it is incorporated.

2. *Fluids which enter the blood.* These fluids are the chyle and the lymph. The chyle, the result of the process of digestion, is a whitish liquid, and is slightly coagulable when it comes from the first chyloferous vessels, more coagulable and of a rosy teint in the mesenteric ganglions, and of a rose-colour in the thoracic canal.

3. *Fluids which derive their materials from the blood.* All the molecules which enter into the composition of our organs, or which are expelled from them, are extracted from the blood, and are first in a liquid state. These fluids may be divided into three classes: 1. Those which serve directly for assimilation, for the growth and reparation of our organs: they are the *nutritious fluids*. 2. Those deposited in certain cavities, and in the interstices of the organs: these are the fat, the serum, the synovia; or which are exhaled from the surface of the body, as the

matters exhaled from the skin or lungs. 3. Those, the materials of which being furnished by the blood, are submitted to the action of a particular kind of organs termed *glands*, and which are the result of this elaboration. They are the mucus, the sebaceous matter, the tears, the saliva, the bile, the pancreatic fluid, the milk, the semen, the urine.

#### OF THE DIFFERENT KINDS OF TISSUES, AND OF THE ORGANIC SYSTEMS.

The number of the elementary tissues of the body varies with different authors. Bichat admits twenty-one of them, three of which generate the others. These are the cellular, the nervous system of animal life, the nervous system of organic life, the arterial, the venous, the exhalant, the absorbent, the osseous, the medullary, the cartilaginous, the muscular system of animal life, the muscular system of organic life, the mucous system, the serous, the synovial, the glandular, the dermoid, the epidermoid, and the pilous.

Béclard and Meckel have diminished the number of these systems, uniting several under the same term. We shall follow the order of Meckel, with a slight modification. At the commencement of each apparatus, the systems will be described in the following order: the cellular system, the osseous, the fibrous, the cartilaginous, the fibro-cartilaginous, the nervous, the tegumentary, the vascular, the serous, and the glandular systems. But as the student, on commencing the study of anatomy, should have a clear idea of the different kinds of organs, we shall here describe them briefly. These organs are, 1. The cellular and adipose tissue; 2. The bones; 3. The cartilages; 4. The ligaments; 5. The fibro-cartilages; 6. The muscles; 7. The tendons; 8. The aponeuroses; 9. The nerves; 10. The arteries; 11. The veins; 12. The lymphatics; 13. The lymphatic ganglions; 14. The glands; 15. The follicles; 16. The horny tissue.

1. *Cellular tissue, or cellular system.* Definition.—

The term cellular tissue is applied to the soft, spongy, and whitish tissue which is distributed in every part of the body, is interposed between our organs, connects them with each other, surrounds them, and penetrates into them to contribute to their structure.

*Division.*—The cellular tissue is divided into *general*, or *common*, and *special*. The first, considered as a whole, presents the general conformation of the body; which, with the exception of the skin, is completely enveloped by it. The quantity of common cellular tissue varies much, according to the regions of the body examined. The parts of this tissue which are exterior to the organs, communicate with those on the inside by openings on the surface of the body, and by the passage of the nerves and vessels.

The *special cellular tissue* forms around all the organs a special envelope, and then penetrates within them. This external layer varies according to the organs. That of the muscles is termed their common membrane; the skin, the mucous membranes, the serous membranes, the vessels, the excretory canals, have only their attached surface lined by a layer of cellular tissue. In the interior of the organs, the cellular tissue envelops even the smallest parts of their substance. Thus each fasciculus, each fibre, and each muscular fibril, the glands, and each of the small globules which compose them, appear to have a cellular pouch or sheath.

*Structure.*—The cellular tissue presents itself in the form of whitish and thin layers and filaments, which intercross in different directions, and leave between them permanent, irregular, and very variable areolæ, all of which communicate with each other.

*Vital properties.*—In the healthy state the sensibility of this tissue is very slight. It is susceptible of very manifest vital contractions.

*Functions.*—The general cellular tissue serves to unite the organs, and to facilitate their motions by its suppleness and elasticity. The special cellular tissue forms an atmosphere around each organ, and

thus separates it from the adjacent organs. The cellular tissue exhales a serous fluid, which constantly moistens it, and facilitates the motions of the contiguous parts.

*Adipose tissue.* The *adipose* or *fatty tissue* consists of small vesicles, which are united in masses of various sizes, in the form of layers, buttons, masses, &c., which are filled with fat. *Situation.*—It is found abundantly under the skin of the face, neck, anterior part of the chest, abdomen, buttocks, palms of the hands, and soles of the feet. Within the body, it is seen more particularly around the large vessels, on the surface of the heart, around the kidneys, &c. It constitutes the *marrow* of the long bones, and the fat deposited in the cellules of reticular and spongy substances. *Structure.*—The adipose tissue is formed of small oblong masses, which have bloodvessels, and which are themselves composed of miliary grains. These grains, when viewed with a microscope, are seen to be formed by the agglomeration of numerous small, slightly-compressed, and transparent vesicles; their parietes are difficult to be distinguished, and are probably a particular kind of cellular tissue. These vesicles are united by a very delicate cellular tissue. They receive bloodvessels. *Vital properties.*—The adipose tissue has no sensibility; its contractility is very slight. *Functions.*—The adipose vesicles serve as a reservoir for the fat, a yellowish, inodorous substance, having a mild taste, fluid during life, solid after death, lighter than water, fusible at 100° centigrade, insoluble in water, but soluble in boiling alcohol. The fat seems designed as a reserve of nutriment. The layers it forms in several places preserve certain parts from the constant pressure to which they are subject.

2. *Bones.* The *bones* are the hardest, the most compact, and the most resisting parts of the human body; they form the framework of the body, serve to support and sustain the other organs, and are composed of gelatin and of phosphate of lime, the proportions of which differ at different periods of life.

3. *Cartilages*. The *cartilages* are of a grayish white, less compact, less resisting, and more elastic than the bones. They are flexible and compressible. They are found at the extremities of all the bones united by immoveable articulations, and in the composition of some organs. They are reduced into gelatin by ebullition.

4. *Ligaments*. The *ligaments* are destined, as their name indicates, to bind parts together, and appear in the form of membranes, or of fibrous cords; they are compact, rounded, whitish, and glistening, and their extremities are attached to the bones, around the articulations.

5. *Fibro-cartilages*. The *fibro-cartilages* are ligaments incrustated with gelatin, thus participating in the qualities of ligaments and cartilages. They are very flexible, very elastic, and very resisting; they form certain organs, as the external ear, &c.

6. *Muscles*. The *muscles* are soft, red, or reddish organs, composed of highly contractile fibres, having extremely various shapes, according to the motions they are destined to produce under the influence of the will. Thus, we have long, short, broad, flat, peniform muscles, &c. They form what is commonly called the *flesh*.

7. *Tendons*. The *tendons* are a kind of rounded or flat fibrous cords, which are very firm, white, and glistening: one of their extremities is attached to the muscles, the other to the bones; they are thus the instruments for transmitting the motions of the muscles to the osseous system.

8. *Aponeuroses*. The *aponeuroses* differ from the tendons only in form. They are a kind of fibrous, hard, resisting, and shining membranes, which serve to envelop the muscles, and to give points of attachment to their fibres. They are fixed to the bones like the tendons.

9. *Nerves*. The *nerves* are the conductors of sensation and motion. They have the form of soft whitish cords, formed of small filaments, united by



cellular tissue, and divide in the organs into branches and twigs, which constantly diminish.

10. *Arteries.* The *arteries* are vessels\* arising from the heart by two trunks; they ramify in every part of the body, and carry the blood from the heart into all the organs.

11. *Veins.* The *veins* are vessels which arise from all the organs by an infinite number of small twigs; they terminate in the heart by a few large trunks, and return the blood from all parts of the body to this organ.

12. *Lymphatic vessels.* The *lymphatic vessels* are transparent vessels, which are thinner and generally smaller than the arteries and veins; they are destined for the circulation of a fluid termed the *lymph*, which they carry into the veins.

13. *Lymphatic glands.* The *lymphatic glands* are small, soft, reddish, or grayish rounded bodies, the structure of which is but little known; they receive lymphatic vessels, and transmit them to their common trunk.

14. *Glands.* The *glands* are more or less rounded and flattened organs, very variable in their size, form, and structure, but having for a common character the power of separating, by a special process, a liquid peculiar to each gland; this liquid, by means of canals termed *excretory ducts*, is rejected or retained for some time in kinds of reservoirs.

15. *Follicles or crypts.* These are a kind of small ampullæ or membranous vesicles; they are rounded or lenticular; they prepare a special fluid, which is distributed on the surface of the part they contribute to form.

16. *Horny tissue.* At first view, the horny tissue seems inorganic. Apparently it contains neither vessels nor nerves. To this belong the epidermis, the hair of the head and body, and the nails.

\* The term *vessel* is applied to every kind of canal formed of superimposed membranes, and serving for the circulation of the fluids.



## DESCRIPTIVE ANATOMY.

## DIVISION OF DESCRIPTIVE ANATOMY.

DESCRIPTIVE Anatomy was formerly divided into five parts, viz.: *Osteology*, or the description of the bones: *Myology*, or the description of the muscles: *Angiology*, or the description of the vessels: *Neurology*, or the description of the nerves: and *Splanchnology*, or the description of the viscera, that is, of the organs contained in the head, chest, and abdomen. This distribution, which was advantageous for the purposes of dissection, is inconvenient, as in the description it separates parts the functions of which are analogous. We, however, shall follow a physiological classification, and shall study the different organs in the order of the systems of which they make part.

The systems in man are divided into three classes, founded on the functions they are destined to fulfil. The first comprises the organs which serve to connect him with surrounding beings. The second treats of those which contribute to the nourishment, growth, and reparation of the body. The third makes known the genital organs, which reproduce the individual and preserve the species. The series of functions belonging to these classes of organs constitute a particular mode of existence termed *life*.

The organs of the first class, or of the *life of relation*, form five systems, viz.: the external sensitive system, the internal sensitive system, the conducting system of sensation and of motion, the locomotive apparatus, and the vocal apparatus. Those of the second class, or of the *life of nutrition*, comprise five systems, viz.: the digestive, the respiratory, the circulatory, the absorbent, and the secretory systems. The third class includes the genitals of the male, the genitals of the female, and the product of the union of the two sexes.

The following table shows at a glance the division of the systems, and also the organs which compose each system.

## CLASS I.

## SYSTEMS OF THE LIFE OF RELATION.

- |  |   |  |
|--|---|--|
| I. External sensitive apparatus                        | { | 1. The eye.  |
|  | { | 2. The ear.  |
|  | { | 3. The nose and nasal fossæ.   |
|  | { | 4. The tongue.   |
|  | { | 5. The skin.   |
| II. Internal sensitive apparatus                       | { | The encephalon (cerebrum, cerebellum, medulla oblongata, medulla spinalis), and its membranes. |
| III. Apparatus which conducts sensation and motion - - | { | 1. The encephalic nerves.  |
|  | { | 2. The ganglionic nerves.  |
| IV. Locomotive apparatus -                             | { | 1. The bones and their appendages.   |
|  | { | 2. The muscles and their appendages.   |

## CLASS II.

## SYSTEMS OF THE LIFE OF NUTRITION.

- |                               |   |  |
|-------------------------------|---|--|
| I. Digestive apparatus - - -  | { | 1. The mouth.                          |
|                               | { | 2. The pharynx.                        |
|                               | { | 3. The œsophagus.                      |
|                               | { | 4. The stomach.                        |
|                               | { | 5. The small intestines.               |
|                               | { | 6. The large intestines.               |
|                               | { | 7. The peritoneum and the epiploa.     |
| II. Respiratory apparatus - - | { | The lungs and their appendages.        |
| III. Circulatory apparatus -  | { | 1. The heart.                          |
|                               | { | 2. The arteries.                       |
|                               | { | 3. The veins.                          |
| IV. Absorbing apparatus - -   | { | 1. The lymphatic vessels.              |
|                               | { | 2. The lymphatic ganglions, or glands. |
| V. Secretory apparatus - -    | { | 1. The lachrymal passages and glands.  |
|                               | { | 2. The salivary glands.                |
|                               | { | 3. The liver.                          |
|                               | { | 4. The pancreas.                       |
|                               | { | 5. The kidneys and urinary passages.   |
|                               | { | —The spleen.                           |

## CLASS III.

## GENITAL APPARATUS.

- |  |   |   |
|--|---|---|
| I. Male genital apparatus - -                    | { | 1. The testicles and spermatic cord.            |
|  |   | 2. The seminal vesicles.                        |
|  |   | 3. The penis.                                   |
| II. Female genital apparatus                     | { | 1. The vulva and vagina.                        |
|  |   | 2. The uterus and ovaries.                      |
|  |   | 3. The mammæ.                                   |
| III. Product of the union of the sexes - - - - - | { | 1. The membranes of the fœtus and the placenta. |
|  |   | 2. The fœtus.                                   |

Although this classification, founded on physiology, is the most methodical and the most natural, we cannot conform to it exactly in describing the organs; as we must avoid commencing anatomy by studying the most complex parts enclosed in cavities before we are acquainted with those cavities. Hence we shall precede the examination of the external sensitive apparatus, by describing the bones and the muscles.

## CLASS I.

## SYSTÈMS OF THE LIFE OF RELATION.

## ORDER I.

## LOCOMOTIVE APPARATUS.

It is the function of the locomotive apparatus to execute the different motions which are under the control of the will. It is composed of two kinds of organs: the passive organs of motion, viz., the bones and their appendages; and the active organs of these motions, the muscles and their appendages.

## GENUS I.

## THE BONES AND THEIR APPENDAGES.

The bones and their appendages must be studied in regard to general and to descriptive anatomy.

## ARTICLE I.

*The Bones Generally, or the Osseous System.*

The osseous system is composed of a great number of pieces, which are harder than the other solid parts, and which are united to form a sort of frame, which serves to sustain the other organs, and determines the general form of the body. The bones are situated in the centre of the soft parts.

*General Formation.*—They are divided into long, broad, short, and mixed, which we shall describe after stating the eminences and depressions on their surfaces.

The eminences are *articular* or *non-articular*. The 1st are covered with cartilage; the 2d, which are designed principally for the insertion of fibrous parts, are termed *apophyses*, *processes*, *rami*, when they are prominent and long; *tuberosities* and *protuberances*, when they are shorter and broader; *crests*, when they are prominent and extensive; *spines*, when they are smaller and sharp; *lines*, when long and but slightly prominent.

The *depressions* or *cavities* are also *articular* and *non-articular*. These have received different names according to their forms. Every deep and irregular cavity is termed a *fossa*; a superficial cavity is called an *impression*; a cavity communicating externally by a narrow opening, a *sinus*, *cavern*, or *cellule*; *grooves*, *furrows*, *fissures*, are narrow and long depressions, which receive nerves or vessels, &c.

The *long* bones have a medullary canal, and are situated in the limbs. They are divided, 1. Into the *body*, or *diaphysis*, a central, long, and irregularly cylindrical or prismatic part, in which are seen lines

for the insertion of muscles; 2. Into *extremities*, which are thick and large, and which present apophyses, eminences, and articular cavities.

The *broad* and *flat* bones form the parietes of the skull, chest, and pelvis. They are lamellar, quadrilateral, semilunar, more or less curved, thicker on the edges than in the centre, while their surfaces present inequalities.

In the *short* bones the three dimensions are nearly equal. They are situated in the vertebral column, in the hands and feet. They are globular, cuneiform, cuboid, &c.

The *mixed* bones partake of the characters of the preceding classes. Among these are classed the sphenoid, the temporal, the occipital bones, &c.

*Structure.*—The bones are composed of two substances: one exterior and hard, termed the *compact* substance; the other internal, termed the *spongy*, *areolar*, *reticular*. In the broad bones it is called *diploic*. The body of the long bones is formed of compact substance; its centre presents a cavity termed the *medullary canal*. The flat bones are formed by two compact tables, between which is the *diploe*, which occupies the thickest portions of these bones.

The bones are covered externally by a fibrous, white, brilliant, and pearly membrane, termed the *periosteum*. The articular surfaces of the bones are destitute of this envelope.

The medullary cavity of the long bones is lined by a very thin and transparent membrane, the *medullary* membrane. This membrane forms kinds of vesicles analogous to the fatty vesicles in which the marrow is secreted.

*Physical, chymical, and vital properties.*—The bones are yellowish-white, very hard, very resisting, and slightly elastic. They are composed principally of gelatin, phosphate of lime, and of some other salts of lime, and magnesia. The bones are insensible in the healthy state.

*Functions.*—The bones serve passively for loco-

tion, performing the office of levers, which are moved by the muscles, and giving attachment to these muscles ; they also form cavities to contain and protect the principal organs of life.

## ARTICLE II.

### *Osteology ; or, a Description of the Bones in Detail.*

[*Preparation of the Bones.*—The soft parts are removed in a rough way, without disturbing the periosteum ; they must then be macerated in water until this membrane is detached spontaneously ; they must now be taken from the water, rubbed with a soft brush, and then washed with fresh water. If they are now exposed to the light and air, they may be bleached, and will become very white.]

### OF THE SKELETON AND ITS DIVISIONS.

The skeleton is the assemblage of all the bones in their natural relations. The skeleton is termed *Natural* or *Artificial*, according as the parts which compose it are united together by their proper ligaments, or by other connexions.

It is formed of 240 bones, and is divided into three parts ; the head, trunk, and extremities.

The head comprises the cranium and face. The cranium is composed of eight bones ; the *frontal*, the *parietals*, the *ethmoid*, the *sphenoid*, the *temporals*, and *occipital*. To these may be added the proper bones of the ear comprised in the temporal bones, viz., the *malleus*, *incus*, *stapes*, and *os orbiculare*.

The face is divided into the superior and inferior maxillæ. The superior is formed by the *superior maxillary* bones, the *nasal*, the *malar*, the *lachrymal*, the *palatine*, the *inferior turbinate*d bones, and the *vomer*. The second embraces only one bone, the *inferior maxillary*. To the face we must add the thirty-two *teeth* and the *os hyoides*.

The trunk is divided into the *vertebral column*, *thorax*, and *pelvis*. The vertebral column consists of twenty-four bones, termed the *vertebræ*. The *thorax* is formed by the *sternum* and twenty-four *ribs*,

twelve on each side. The *pelvis* consists of the two *iliac*, the *sacral*, and the *coccygeal* bones.

The *extremities* are divided into the *superior* or *thoracic*, and *inferior* or *abdominal*.

The *superior* extremities consist of, 1st, The *shoulder*, formed by the *scapula* and *clavicle*; 2d, The *arm*, formed by the *humerus*; 3d, The *fore-arm*, composed of the *radius* and *ulna*; 4th, The *hand*, divided into the *carpus*, *metacarpus*, and fingers. The *carpus* consists of eight bones placed in two rows. The first row comprises the *scaphoid*, *semilunar*, *pyramidal*, and *pisiform* bones; the second, the *trapezium*, *trapezoides*, *os magnum*, and *os unciforme*. The *metacarpus* is formed by five bones, termed numerically the first, second, &c., counting from without inward. The fingers, in number five, are each formed by three bones, termed *phalanges*, which are distinguished into first, second, and third, except the thumb, which has but the first and third.

The *inferior* extremities are divided into, 1st, The *thigh*, formed by the *femur*; 2d, The *leg*, composed of three bones, the *tibia*, *fibula*, and *patella*; 3d, The *foot*, divided into the *tarsus*, *metatarsus*, and toes. The *tarsus* consists of two ranges of bones; in the first we find the *calcaneum* and *astragalus*; in the second, the *scaphoid*, the three *cuneiform* and *cuboid* bones. The *metatarsus* comprises five bones, named in numerical order, counting from within outward. The toes, five in number, are formed each of three *phalanges*, except the great toe, which has but two.

## OF THE HEAD.

The head is in the form of a spheroid, elongated from before backward, and flattened on the sides. It is the superior part of the skeleton, is supported by the vertebral column, with which it articulates, and is divided into the *cranium* and *face*.

## 1. THE CRANIUM.

This is an osseous box, of an oval shape, the largest diameter of which is the antero-posterior, and its large extremity is posterior; it forms the superior and posterior parts of the head; it contains the brain, and is formed anteriorly by the *frontal* bone; laterally and superiorly, by the *parietals*; laterally and inferiorly, by the *temporals*; posteriorly, by the *occipital*; inferiorly and in front, by the *ethmoid*; inferiorly and posteriorly, by the *sphenoid*. Farther, the *temporals* contain the small bones of the ear, and sometimes we perceive between the bones of the cranium some bones of an irregular shape, termed the *ossa triquetra*.

## THE FRONTAL, OR CORONAL BONE.

*Situation*.—At the anterior and superior part of the cranium. *Figure*.—Symmetrical, semicircular, convex in front, concave behind, divided into two surfaces and two borders.

*Frontal, or anterior surface*.—We observe here, 1st, On the median line, and from above downward, a linear longitudinal mark, which indicates the suture of the two pieces which form this bone in infancy; the nasal prominence; the nasal groove, which articulates with the nasal bones and with the ascending process of the superior maxillary bone; the nasal spine, which unites with the nasal bones and with the vertical plate of the ethmoid, and presents, on its sides, two longitudinal grooves; the ethmoidal groove receiving the ethmoid, and presenting laterally the opening of the frontal sinuses. 2d, On the sides, and from above downward, we observe a plain surface covered by the frontalis muscle; the frontal prominence; the superciliary ridge giving attachments to the corrugator supercilii; the orbital arch, terminated by the external and internal orbital processes, which articulate, the first with the malar, the second with the lachrymal bone. On the inner side



we see the supra-orbital foramen ; posteriorly, a portion of the temporal fossa, and beneath this, the orbital cavity, which presents on its outer side the depression for the lachrymal gland, and on the inner, the insertion of the cartilaginous pulley of the great oblique muscle of the eye.

*Cerebral, or posterior surface.*—We observe here, 1st, On the median line, the groove for the superior longitudinal sinus ; a crest for the insertion of the falx cerebri, and the foramen cœcum. 2d, Laterally, the mamillary eminences, the digital impressions, and the coronal fossæ.

*Superior border.*—It is thick, dentated, and articulates with the parietals, and by its extremities with the great wings of the sphenoid bone.

*Inferior border.*—It is straight, thin, and uneven, and unites with the lesser wings of the sphenoid bone. The frontal bone is formed of two layers of compact substance, separated by a layer of diploe : within it the *frontal sinuses* are situated. In the fœtus the two lateral pieces of it may be traced in the second month. The most usual anomaly presented by it is the want of union between these two lateral pieces.

#### THE PARIETAL BONES.

*Situation.*—On the superior and lateral parts of the cranium. *Form.*—Irregular, convex externally, concave internally, quadrilateral, divided into two surfaces and four borders. *External surface.*—We observe, on the supero-posterior part, the parietal foramen ; on the middle, the parietal prominence ; and below, the line of boundary of the temporal fossa. *Internal, or cerebral surface.*—Presents deep grooves for the branches of the middle meningeal artery ; slight digital impressions ; superiorly, a portion of the longitudinal groove ; in the middle, the parietal fossa or depression. *Borders.*—The *superior* articulates with its fellow ; the *inferior*, with the temporal bone ; the *anterior*, with the frontal ; the *posterior*, with the occipital. The *anterior inferior* angle

articulates with the sphenoid, presenting internally a deep groove for the middle meningeal artery. The *posterior inferior* angle articulates with the mastoid portion of the temporal, presenting internally a portion of the lateral groove. Each parietal bone develops itself by a single point of ossification, which first appears in the parietal protuberance. *Anomalies.*—Sometimes the sagittal suture is effaced, and the parietal bones become one. Sometimes they are divided by a transverse suture into an upper and lower portion.

#### THE ETHMOID BONE.

*Situation.*—At the antero-inferior and middle part of the cranium, in the fissure of the frontal bone. *Form.*—A cube, divided into four surfaces. *Superior, or cerebral surface.*—We observe here, 1st, On the median line, and from behind forward, a small notch, and sometimes a process articulating with the orbito-nasal surface of the sphenoid bone; the crista galli process, a pyramidal eminence giving attachment to the falx cerebri, and uniting by two small eminences with the frontal bone. 2d, On the sides, we notice a broad groove, pierced by numerous holes, ten or twelve of which, more apparent, are traversed by filaments of the olfactory nerves; in front of each groove, a small longitudinal fissure for the internal branch of the nasal nerve; more outwardly, a cellular and quadrilateral surface, articulating with the frontal bone, and presenting two grooves, which concur to form the internal orbital passages. *Inferior or nasal surface.*—We perceive here, 1st, On the middle line, the *perpendicular plate of the ethmoid*, forming part of the septum of the nasal fossæ, and articulating below with the vomer and the cartilage of the nose, anteriorly with the nasal spine of the frontal bone and the nasal bones, and posteriorly with the septum of the sphenoidal sinuses. 2d, On the sides of this plate, a deep fissure, bounded on the outer side by a rough surface, which presents from above downward the superior turbinated bone, the

*superior meatus*, in front of which is the opening of the posterior ethmoid cells; the middle turbinated bone of the nasal fossæ, which is thin and bent, and which articulates with the palatine bone; the *middle meatus*, in front of which we perceive the opening of the anterior cells. Inferiorly, the sides of this surface present many curved plates, and portions of cells, which articulate with the opening of the maxillary sinus and with the inferior turbinated bone.

*Posterior, or sphenoidal surface*.—1st, On the middle line, the posterior border of the perpendicular plate. 2d, Laterally, an uneven surface, articulating above with the sphenoid bone, in the middle with the superior turbinated bone, and below with the palate bone.

*Anterior, or naso-maxillary surface*.—Here we see, 1st, In the middle, the anterior border of the perpendicular plate. 2d, On each side, portions of cells, covered by the ascending processes of the superior maxillary bone.

*Lateral, or orbital faces*.—They are irregular at their anterior extremity, but smooth in other parts, where they form the internal wall of the orbit; they articulate superiorly with the frontal bone; inferiorly with the palatine and superior maxillary; anteriorly with the lachrymal; and posteriorly with the sphenoid bone.

*Development*.—The ethmoid bone is not developed till the fifth month of pregnancy; the lateral portions appear first; the middle part remains cartilaginous till birth.

#### THE SPHENOID BONE.

*Situation*.—At the inferior and middle part of the cranium. *Figure*.—Symmetrical, irregular, divided into six surfaces.

*Inferior surface*.—We observe, 1st, On the middle line, a crest articulating with the vomer. 2d, Laterally, and from within outward, a small fissure joining the plate of the vomer; a small groove concurring to

the formation of the pterygo-palatine groove; and the pterygoid process. This last is a vertical eminence, forming a portion of the inner part of the nasal fossæ, and giving attachment externally to the external pterygoid muscle; it articulates in front with the palatine bone, and forms a part of the zygomatic fossa; it is hollowed posteriorly by the *pterygoid fossa*, which gives attachment to the internal pterygoid muscle, and is formed by two plates termed *wings*, the internal of which gives insertion, superiorly, to the circumflexus palati muscle, and inferiorly, to the superior constrictor of the pharynx; it is pierced at its base by the vidian canal, bifurcated at its summit, the internal side of which forms a hook, and reflects the tendon of the circumflexus palati; lastly, on the outer side, and posterior to the pterygoid processes, are the orifices of the foramen ovale and rotundum.

*Superior, or cerebral surface.*—Here we perceive, 1st, On the median line, and from behind forward, a quadrilateral plate; posteriorly forming a part of the basilar groove; terminated superiorly by two angles, termed the posterior clinoid processes, to which is attached a fold of the tentorium cerebelli; the pituitary fossa, which lodges the pituitary body; a transverse groove, on which rests the junction of the optic nerves; lastly, two superficial depressions, separated by a prominence, and occupied by the olfactory nerves. 2d, Laterally, and from behind forward, is the small round foramen for the middle meningeal artery; the foramen ovale for the passage of the inferior maxillary nerve; the foramen rotundum for the superior maxillary nerve; on the outer side of this foramen is a concave and cerebral surface; on the inner side is the cavernous groove, for the cavernous sinus and carotid artery; anteriorly is the wing of Ingratius, a triangular eminence, forming, superiorly, a part of the cranial cavity; inferiorly, a part of the orbit; it is articulated anteriorly with the frontal bone; presents at its base and on the inner side the anterior clinoid process, to which is attached the tentorium cerebelli;

the optic hole, for the optic nerve and ophthalmic artery; and beneath this, the sphenoidal fissure, through which pass the ophthalmic branch of the fifth pair of nerves, the third, fourth, and sixth pair, the optic vein, and a branch of the lachrymal artery.

*Posterior, or occipital surface.*—1st, On the middle line, we observe here a rough quadrilateral surface, articulated with the basilar process of the occipital bone. 2d, On the sides, an irregular border, presenting the posterior orifice of the vidian canal; concurring to form the foramen lacerum anterius; and articulated with the petrous portion of the temporal bone.

*Anterior, or orbito-nasal surface.*—1st, On the median line is a prominent crest, capped by a small process, and articulated with the ethmoid bone. 2d, On the sides, the opening of the sphenoidal sinuses, cavities of some depth, separated by a septum, and in a great part closed up by a thin, irregular-shaped plate; inferiorly, irregular surfaces articulated with the ethmoid and palate bones; from within outward, the optic foramen, the sphenoidal fissure, the foramen for the superior maxillary nerve, and a smooth quadrilateral surface, forming the external wall of the orbit, surmounted by a triangular and rough surface, which articulates with the frontal bone; presenting inferiorly a crest, which forms a part of the sphe-no-maxillary fissure, and superiorly a denticulated border, articulating with the malar bone.

*External, or zygomato-temporal surface.*—In the middle we see a crest, where the temporal bone is inserted; higher up, a quadrilateral surface, forming a part of the temporal fossa; beneath the crest, another surface, forming part of the zygomatic fossa, and giving attachment to the external pterygoid muscle.

*Frontal edge.*—Separating the anterior and superior surfaces, and articulating with the frontal bone.

*Temporal border.*—Separating the superior and external surfaces; united with the temporal bone; terminating superiorly in an unequal surface, articulating with the parietal bone, and inferiorly in an eminence termed the *sphenoid spine*, articulating with the temporal bone.

*Development.*—The osseous nuclei first appear in the large wings of the sphenoid bone at the third month of pregnancy; next, one forms for each internal layer of the pterygoid processes; then we see a third pair in the small wings; then a seventh and eighth nucleus, which afterward unite in the body; at five months a fifth pair forms between the fourth pair and the wings; a sixth pair is soon developed at the inner part of the circumference of the optic foramen; and finally a seventh appears between this and the fourth. These nuclei unite, and at birth the sphenoid bone consists of three pieces.

#### THE OCCIPITAL BONE.

*Situation.*—At the posterior and inferior part of the cranium. *Form.*—Flat, symmetrical, concave in front, convex behind, curved on itself, of a lozenge shape, divided into two surfaces and four borders.

*Posterior surface.*—We observe here, 1st, On the middle line, and from above downward, a smooth surface of slight extent; the *external occipital protuberance*; the *external occipital crest*, to which is attached the posterior cervical ligament; the *occipital foramen*, an elliptical opening traversed by the spinal marrow, its membranes, the vertebral artery and spinal nerves; finally, the *basilar surface*, covered by the membrane of the pharynx, and giving attachment to the recti antici muscles. 2d, On either side, and from above downward, a surface covered by the occipital muscle; the *superior curved line*, into which are inserted the trapezius and sterno-mastoid muscles; impressions where the splenius and great and little complexus muscles are attached; the *inferior curved line*; impressions for the attachment of the posterior recti and little oblique muscles; the occipital condyle, which is an eminence elongated from before backwards, articulating with the atlas, and giving attachment on the inner side to a ligament coming from the odontoid process; bounded externally by a surface for the insertion of the rectus capitis lateralis; presenting an-

teriorly a depression, and the anterior condyloid foramina for the hypoglossal nerves; posteriorly, another depression, and the *posterior condyloid fossa* and *foramen* for the arterial and venous vessels.

*Anterior, or cerebral surface.*—Here we remark, 1st, On the middle line, and from above downward, the groove of the superior longitudinal sinus; the *internal occipital protuberance*; the *internal occipital crest*, to which is attached the *falx cerebelli*; the occipital foramen, and the basilar groove, which supports the pons varolii. 2d, On either side, and from above downward, the *superior occipital fossa* for the posterior lobe of the brain; the *lateral groove*, broad and transverse, lodging the lateral sinus; the *inferior occipital fossa* for the cerebellum; the internal orifice of the posterior condyloid foramen, placed in the middle of a portion of the lateral groove; the internal orifice of the anterior condyloid foramen; a small groove situated on the sides of the basilar groove, and receiving the inferior petrous sinus.

*Superior borders.*—Deeply denticulated and articulated with the parietal bones. *Inferior borders.*—Presenting anteriorly an elongated surface, united to the petrous portion of the temporal bone; posteriorly, a notch concurring to form the foramen lacerum posterius; beyond this the jugular process articulating with the temporal bone; higher up, a denticulated border articulating with the temporal bone. *Superior angle.*—Articulated with the parietals. *Inferior angle.*—Forming a square surface united to the sphenoid bone. *Lateral angles.*—Articulated with the mastoid portion of the temporal bone. *Development.*—The occipital bone is usually formed by eleven points of ossification, eight for the squamous portions, and three for the articular and basilar portions. The rudiment of the squamous portion is seen at the second month, the others at a later period.



## THE TEMPORAL BONE.

*Situation.*—On the lateral and inferior parts of the cranium. *Form.*—Irregular, flattened from within outward, presenting eminences and cavities; divided generally by anatomists into three portions, a superior or scaly, a posterior or mastoid, and an inferior or petrous; they present two surfaces and one circumference.

*External, or auricular surface.*—We observe here, in front and above, a surface forming a part of the temporal fossa, and giving attachment to the temporal muscle; underneath, the *zygomatic process*, a horizontal eminence looking forward and outward, giving attachment by its superior border to the temporal aponeurosis, by its inferior and internal surface to the masseter muscle, and covered externally by the skin; also articulating by its summit with the malar bone, divided at its base into two roots, the one, inferior, anterior, and transverse, concurring to form the temporo-maxillary articulation; the other, posterior and superior, bifurcated, concurring to form by its superior division the line of boundary for the temporal fossa, its inferior being directed to the *glenoidal fissure*. This opening leads into the cavity of the tympanum, and gives passage to the tendon of the anterior muscle of the malleus, and to the nerve called the *corda tympani*. Between the two roots of the zygomatic process is the *glenoid cavity* of the temporal bone, divided into two portions by the glenoid fissure, of which the anterior articulates with the condyle of the lower jaw. Behind the glenoid cavity, and on the outer side, we see the external auditory foramen, with an irregular margin for the attachment of the fibro-cartilage of the ear, and directed forward and inward, opening into the cavity of the tympanum; more posteriorly and a little inferiorly is the mastoid process, giving attachment to the sterno-mastoid muscle; a little superiorly is a small rough surface, to which the sterno-mastoid, splenius, and complexus minor mus-



cles are attached; in the same place is the mastoid foramen, which gives passage to an artery and vein. Beneath the mastoid process is the *digastric groove*, for the attachment of the digastricus muscle, and near the former a small groove for the complexus minor muscle.

*Internal, or cerebral surface.*—Superiorly, we observe an elongated rough surface, united to the inferior border of the parietal bone; inferiorly is a concave surface, corresponding to the middle lobes of the brain; at the inferior posterior part is a deep groove, containing the orifice of the mastoid foramen, and lodging a portion of the lateral sinus. In the middle of this face is the petrous portion, a pyramidal triangular eminence, directed forward and inward; it presents, 1. On its superior surface, the *hiatus Fallopii*, and a small groove for a nervous filament of the sphenopalatine ganglion. 2. On its posterior surface, the orifice of the internal auditory foramen, traversed by the acoustic and facial nerves, and at the bottom of which opens the aqueduct of Fallopius, a long narrow canal, terminating in the stylo-mastoid foramen, receiving the hiatus Fallopii, and lodging the facial nerve; a narrow fissure, where the aqueduct of the vestibule terminates. 3. On its superior border, which separates its two surfaces, a depression for the fifth pair of nerves, and a groove which lodges the superior petrous sinus. 4. Inferiorly, we observe a rough surface, where the fibres of the levator palati and tensor tympani muscles are inserted; the orifice of the *carotid canal*; the *jugular fossa*, lodging the commencement of the jugular vein; a small surface articulating with the occipital bone; the stylo-mastoid foramen for the passage of the facial nerve; the *styloid process*, a long thin eminence, to which are attached the stylo-hyoideus, the stylo-glossus, and stylo-pharyngeus muscles, as also the stylo-maxillary and stylo-hyoid ligaments; in fine, the vaginal process, forming the posterior limit of the glenoid cavity. 5. At its *anterior border*, the articulation of the petrous portion with the sphenoid bone. 6. Its infero-poste-

rior border we find united with the occipital bone, and presenting a groove divided into two parts by a small bony plate, and concurring to form the foramen lacerum anterius, and the internal orifice of the carotid canal, traversed by the carotid artery.

*Circumference.*—We perceive at its union with the anterior border of the petrous portion two openings, separated by a plate, the one for the passage of the tensor tympani muscle, the other forming the orifice of the Eustachian tube. This circumference is rounded, semicircular, and articulates in front with the sphenoid bone, superiorly with the parietal, and posteriorly with the occipital.

*Development.*—In the full-grown fœtus, the temporal bone is formed of four pieces, the *petrous*, mastoid, and squamous portions, and the ring of the tympanum.

#### THE OSSA TRIQUETRA.

Their existence is not constant. *Situation.*—Placed between the bones of the cranium, most frequently in the suture formed by the occipital and parietal bones; sometimes constituting the superior angle of the former. *Figure.*—Irregular. Their surfaces similar to those of the bones of the cranium; their borders articulating with these latter.

### II. OF THE CRANIUM IN GENERAL.

*Dimensions.*—Its antero-posterior diameter, extending from the foramen cœcum to the internal occipital protuberance, is about five inches. Its great transverse diameter, occupying the space separating the base of the two petrous portions of the temporal bones, is about  $4\frac{1}{2}$  inches: it diminishes both anteriorly and posteriorly to this point. Its great vertical diameter, comprised between the anterior part of the occipital foramen and the centre of the sagittal suture, is a few lines less than the preceding. The cranium is divided into two surfaces. 1st, The *exterior surface*, which presents four regions. *Superior region.*—We observe here, on the median line, and from before

backward, the trace of union of the two halves of the frontal bone; the sagittal suture, formed by the articulation of the parietal bones; the external occipital protuberance; the external occipital ridge, and the occipital foramen. 2d, On each side, and in the same direction, the frontal protuberance; the coronal suture, formed by the union of the frontal with the parietal bones; the parietal prominence; the lambdoidal suture, resulting from the articulation of the parietal with the occipital bone; *and, lastly*, the lateral and external part of the occipital bone, situated above its foramen.

*Inferior region.*—It extends from before backward, from the root of the nose to the posterior part of the occipital foramen, and transversely from one mastoid process to the other. It comprises two portions, a posterior and an anterior. Its posterior portion presents, 1st, On the middle line, and from behind forward, the occipital foramen; the basilar surface; a transverse fissure, indicating the articulation of the occipital with the sphenoid bone. 2d, On each side, and in the same direction, this portion presents the inferior part of the external surface of the occipital bone; a furrow formed by the articulation of the petrous portion of the temporal bone with the occipital; at the posterior extremity of this furrow, the jugular fossa, lodging the commencement of the jugular vein, which communicates with the cavity of the cranium by means of the foramen lacerum posterius; the jugular fossa is divided by a bony plate into two parts, one anterior, traversed by the eighth pair of nerves, and the other posterior, by the jugular vein; at its anterior extremity is the foramen lacerum anterius, which, in the fresh state, is occupied by a cartilaginous substance. This portion also presents the lower face of the petrous portion of the temporal bone; the inferior orifice of the carotid canal; the styloid and vaginal processes; the stylo-mastoid foramen; a furrow resulting from the union of the anterior border of the petrous portion of the temporal bone with the sphenoid, and presenting at its external extremity the

orifices of the osseous portion of the Eustachian tube, and of the canal for the passage of the tensor tympani muscle; the foramen spinale and ovale; in fine, on the sides, the inferior part of the zygomato-temporal surface of the sphenoid bone, and a suture which unites this portion to the temporal. The anterior half of this region presents, 1st, on the median line, and from behind forward, the articulation of the sphenoid bone with the vomer; the union of this latter with the ethmoid plate, and the articulation of this latter with the nasal spine. 2d. On each side, and from within outward, the superior wall of the nasal fossæ; the base of the pterygoid processes; the union of the palatine and sphenoid bones, producing the sphenopalatine foramen; the union of the palatine and sphenoid bones with the ethmoid; the articulation of the lateral parts of this latter with the frontal bone; the union of this latter with the os unguis and nasal bones; and, lastly, a surface which forms the roof of the orbit, terminating externally by a line where the frontal, malar, and sphenoid bones articulate, and which forms the continuation of the sphenoidal fissure.

*Lateral regions.*—Each lateral region, extending from the lambdoidal suture to the external orbital process, presents, 1st, Posteriorly, and from behind forward, the mastoid foramen; the digastric groove; the mastoid process; the orifice of the external auditory foramen; the glenoid cavity. 2d. Anteriorly, the temporal fossa, filled by the temporalis muscle, and formed by the temporal and parietal bones superiorly, by the temporal, sphenoid, and malar inferiorly, and presenting the termination of the coronal suture; another transverse suture, which unites, anteriorly, the frontal and parietal bones with the sphenoid, and the former of these with the malar, and posteriorly, the temporal with the parietal; two other vertical sutures, one anterior, between the malar and sphenoid, and the other posterior, between this latter and the temporal. This fossa is bounded superiorly by a curved line, giving attachment to the aponeuro-

sis of the temporal muscle ; anteriorly, by the posterior border of the malar bone ; inferiorly and inward, by a crest belonging to the zygomato-temporal face of the sphenoid bone ; inferiorly and outward, by the zygomatic arch, an eminence which stands out from the cranium, and which is formed by the junction of the process of the same name with the malar bone.

*Interior surface.*—Concave, and divided into the roof and base of the cranium.

*Roof.*—It presents, 1st, On the median line, and from before backward, the coronal crest ; the sagittal groove for the superior longitudinal sinus. 2d, On each side, and in the same direction, the cerebral region of the frontal bone, with the exception of the orbital fossæ ; the coronal suture ; the cerebral region of the parietal bones ; a part of the lambdoidal suture ; the superior occipital fossæ.

*Base.*—It presents, 1st, On the median line, and from before backward, the foramen cœcum ; the crista galli process and ethmoidal grooves, pierced with foramina, bounded externally by the articulation of the frontal with the ethmoid bone, on which we perceive the orifices of the internal orbital foramina ; a transverse suture, formed by the ethmoid and sphenoid bones ; the smooth surface of this latter bone, on which the olfactory nerves rest ; the transverse groove for the optic nerves ; the optic foramina ; the anterior clinoid processes ; the pituitary fossa ; the grooves for the cavernous sinuses ; the quadrilateral plate of the sphenoid bone, which forms superiorly the posterior clinoid processes ; a transverse line corresponding to the articulation of the occipital with the sphenoid bone ; the basilar groove ; the occipital hole ; the internal occipital crest, and the internal occipital ridge.

2d. On each side, and from before backward, it presents a convex surface, for the support of the anterior lobes of the brain, being formed by the orbital eminences and the wings of Ingratius, which are separated by a transverse suture, and bounded posteriorly by a rounded edge, lodged in the fissure of Syl-

vius; a fossa, broad externally, narrow internally, filled by the middle lobe of the brain, and formed by the sphenoid and temporal bones, bounded anteriorly by the sphenoidal fissure, posteriorly by the superior border of the petrous portion of the temporal bone, presenting the openings of the foramen lacerum anterius, foramen rotundum, ovale, spinale, and of the hiatus Fallopii; finally, another deeper depression, formed by the temporal, occipital, and posterior and inferior angle of the parietal bone, lodging the cerebellum, and bounded anteriorly by the superior border of the petrous portion of the temporal bone, posteriorly by the lateral groove; presenting two sutures, which unite the occipital, the one with the circumference of the temporal bone, the other with the posterior border of its petrous portion. This depression presents on its circumference the lateral groove for the lateral sinus, which is directed at first horizontally, afterward from without inward, and from above downward, formed by the occipital bone superiorly, by the parietal and temporal bones in the middle, and by the occipital inferiorly, terminating in the jugular fossa. The same fossa also presents posteriorly the inferior occipital fossa, and the anterior condyloid foramen; anteriorly the internal auditory foramen, and the orifice of the aqueduct of the cochlea.

### III. OF THE FACE.

It forms the anterior and inferior part of the head, and is bounded superiorly by the cavity of the cranium; laterally, by the zygomatic processes; posteriorly, by the basilar surface of the occipital bone, formed by the superior and inferior maxillæ. The former is composed of the *superior maxillary* bones, the *malar* and the *nasal* bones, the *ossa lachrymalia*, the *palatine*, *inferior turbinated* bones, and the *vomer*. The latter is formed but of one bone, the *inferior maxillary*. The *teeth* belong to both.

## SUPERIOR MAXILLARY BONE.

*Situation.*—At the superior and middle part of the face. *Figure.*—Irregular and very uneven, divided into two surfaces and one circumference.

*Orbito-facial, or external surface.*—We perceive here, anteriorly, the *nasal* or *ascending* process, an elongated vertical eminence, giving attachment superiorly and on its outer side to the levator labii superioris alæque nasi muscle, and forming internally a part of the nasal fossa, and presenting in this direction also inequalities for its articulation with the ethmoid bone; a portion of the middle meatus of the nostrils, and a crest, uniting with the inferior turbinated bone; it articulates anteriorly with the nasal bones; presents, posteriorly, a groove, united by its posterior border to the os unguis, and by its anterior gives attachment to the tendon of the orbicularis palpebrarum muscle; lastly, it articulates superiorly with the nasal notch of the frontal bone. Behind the nasal process is a triangular surface, forming a part of the floor of the orbit, giving attachment to the inferior oblique muscle of the eye; presenting in its middle the *groove* and *orbital canal*, which lodge the vessels and nerves of the same name, and which is divided anteriorly into two portions; the one anterior, for the infra-orbital nerve, the other posterior, termed the *anterior dental canal*, for the nerve of the same name. This surface is bounded, posteriorly, by a border, which contributes to form the spheno-maxillary fissure; internally, by a border articulating with the palatine bone, the ethmoid, and os unguis; anteriorly, by a border forming a portion of the contour of the orbit. On the outer part of the orbital surface is the *malar process*, a triangular, rough eminence, articulating with the malar bone; in front of this border is the *canine fossa*, pierced superiorly by the *infra-orbital foramen*, which is traversed by the vessels and nerves of the same name, and gives attachment to the levator anguli oris muscle; on the inside of this latter is another depression, sometimes



termed the *myrtiform fossa*, for the insertion of the depressor *alæ nasi* muscles.

*Naso-palatine, or internal surface.*—Here we see, in the centre, the *palatine process*, a quadrilateral and horizontal eminence, corresponding inferiorly to the mouth, and superiorly to the nose; in this latter direction it presents, anteriorly, one of the superior openings of the anterior palatine canal; it articulates, posteriorly, with the palate bone; internally, with its fellow of the opposite side, where it forms, anteriorly, the *anterior palatine canal*; superiorly, a groove for the reception of the vomer. Underneath this palatine process is a grooved and concave surface; above it is a vertical surface; in the middle of the vertical surface is the orifice of the *maxillary sinus*, a deep pyramidal and triangular cavity, which is articulated with the ethmoid, inferior turbinated, and palate bones; at the inferior part of this orifice is a fissure, united to the plate of the palate bone; at its superior part, portions of the cells opening into those of the ethmoid bone; in front of this orifice is a deep groove, forming the greater part of the *nasal canal*; behind the same orifice, a rough surface united to the palate bone, and a groove concurring to form the *posterior palatine canal*.

*Circumference.*—It presents, posteriorly, the *malar tuberosity*, a rough surface, pierced by the *posterior dental canals* for the passage of the vessels and nerves of the same name; anteriorly, a loose edge, concave superiorly, where it concurs to form the anterior opening of the nasal fossæ; straight inferiorly, where it articulates with its fellow; and is topped by the *anterior nasal spine*; inferiorly, the *superior alveolar edge*, thick, parabolic, hollowed by eight conical cavities termed *alveoli*, which receive the teeth, and give attachment, exteriorly, to the buccinator muscle. *Development.*—The superior maxillary bone, in the fœtus of three months, is composed of three pieces; the anterior comprising that portion of the palatine and alveolar processes situated before the palatine duct, with the nasal process; the middle includes the



body and centre of the palatine process; and the third, the posterior part of this process.

#### THE MALAR BONES.

*Situation.*—At the superior and lateral parts of the face. *Figure.*—Irregular, square, divided into three faces, four edges, and four angles.

*External face.*—Giving attachment to the two zygomatic muscles; presenting the malar foramina. *Superior face.*—Forming a portion of the orbits; articulating, posteriorly, by a denticulated border with the frontal, the sphenoid, and superior maxillary bone. *Posterior face.*—Articulating, anteriorly, with the malar tuberosity; forming, posteriorly, part of the temporal fossa.

*Antero-superior edge.*—Forming a part of the contour of the orbit. *Antero-inferior edge.*—Articulating with the superior maxillary bone. *Postero-superior edge.*—Giving attachment to the temporal aponeurosis. *Postero-inferior edge.*—Receiving the insertion of the masseter muscle.

*Superior angle.*—Articulating with the external orbital process of the frontal bone. *Inferior angle.*—United to the malar tuberosity. *Anterior angle.*—Also articulating with the malar tuberosity. *Posterior angle.*—Articulating with the zygomatic process. *Development.*—The malar bone appears early, towards the commencement of the third month, and is composed of one nucleus of bone.

#### THE NASAL BONES.

*Situation.*—At the superior and middle part of the face. *Form.*—Irregularly quadrilateral, divided into two faces and four edges.

*Anterior face.*—Covered by the pyramidal muscle, and presenting a small hole for a vessel. *Posterior face.*—Forming a part of the nasal fossæ.

*Superior edge.*—United to the frontal bone. *Inferior edge.*—Joined to the lateral cartilage of the nose,

and grooved for the passage of the external twig of the internal nasal branch of the fifth pair of nerves. *External edge*.—Articulating with the ascending process of the superior maxillary bone. *Internal edge*.—Articulating with its fellow; presenting posteriorly a crest, on which is a groove, with a line of articulation with the vertical plate of the ethmoid bone and the nasal spine of the frontal. *Development*.—By a single nucleus of bone, which begins to appear at the third month of pregnancy.

#### THE LACHRYMAL BONES.

*Situation*.—At the anterior and internal part of the orbit. *Form*.—Very small, quadrilateral, divided into two faces and four edges.

*External face*.—Hollowed anteriorly by a groove forming a part of the lachrymal groove; plane posteriorly. *Internal face*.—Presenting anteriorly a surface, which forms a part of the middle meatus of the nasal fossæ; posteriorly, inequalities corresponding to the anterior cells of the ethmoid bone.

*Superior edge*.—United to the internal orbital process of the frontal bone. *Inferior edge*.—Articulating anteriorly, by a thin plate, with the inferior turbinated bone; posteriorly with the superior maxillary bone. *Anterior edge*.—Articulating with the nasal process of the superior maxillary bone. *Posterior edge*.—Joined to the ethmoid bone. *Development*.—The ossification of the unguiform bone commences at the fifth month.

#### THE PALATE BONES.

*Situation*.—At the posterior part of the face, beneath the middle part of the base of the cranium. *Form*.—Very irregular, formed by two portions, one of which is horizontal, the other vertical.

1. *Horizontal portion*.—Divided into two faces and three edges. *Superior face*.—Forming a part of the nasal fossæ. *Inferior face*.—Contributing to form the palatine arch; having a crest for the insertion of the

circumflexus palati muscle, and the lower opening of the posterior palatine canal. *Anterior edge*.—Articulating with the superior maxillary bone. *Posterior edge*.—Free, giving attachment to the velum pendulum palati; presenting on the inside the *posterior nasal spine*. *Internal edge*.—United to that of the opposite side; provided with a crest, which concurs to form a groove for the reception of the vomer.

2. *Vertical portion*.—Divided into two faces and three edges. *Internal face*.—It presents two depressions, forming a part of the inferior and middle meatus, and separated by a crest united to the inferior turbinated bone. *External face*.—Almost entirely articulating with the superior maxillary bone; posteriorly, presenting a groove which contributes to form the posterior palatine canal; superiorly, a small surface, which forms a part of the zygomatic fossa. *Anterior edge*.—United to the orifice of the maxillary sinus. *Posterior edge*.—Articulating with the internal wing of the pterygoid process; presenting, at its union with the horizontal portion, the *tuberosity of the palatine bone*, a pyramidal eminence, articulating, posteriorly and superiorly, with the bifurcation of the wings of the pterygoid process; forming a part inferiorly of the palatine arch, and presenting the orifices of the accessory ducts of the posterior palatine canal; contributing, superiorly, to the zygomatic fossa by a small surface, where the external pterygoid muscle is attached. *Superior edge*.—This is formed by two eminences; 1st. anteriorly, the *orbital process*, supported by a neck, which presents on the inner side a crest united to the turbinated bone, presenting five sides, one *anterior*, articulating with the maxillary bone; another *posterior*, hollowed and articulating with the sphenoid; another *external*, forming a part of the zygomatic fossa; another *internal*, joined to the ethmoid; and a fifth, *superior*, forming a part of the floor of the orbit; 2d, posteriorly, the *sphenoidal process*, articulating superiorly with the sphenoid bone, where it forms the pterygo-palatine canal; forming part, on the inner side, of the nasal

fossæ, and on the outer side, of the zygomatic fossa. Between these two processes is a groove, converted by the sphenoid bone into a hole termed the *spheno-palatine* foramen, which is traversed by vessels and nerves. *Development*.—The palatine bone has been found in the fœtus of three months, having the form of a curved plate.

#### THE INFERIOR TURBINATED BONES.

*Situation*.—On the lateral parts of the nasal fossæ. *Figure*.—Irregular, twisted, divided into two faces and two edges. *Internal face*.—Convex, corresponding to the nasal fossæ. *External face*.—Concave, corresponding to the inferior meatus. *Inferior edge*.—Free, twisted on itself. *Superior edge*.—Articulating anteriorly with the nasal process of the superior maxillary bone; posteriorly, with the palate bone by a small crest; united in the middle to the lachrymal bone by a small eminence, and to the maxillary sinus by a very thin plate, curved downward. *Development*.—Ossification commences first about the fifth month of pregnancy, in the centre of the bone.

#### THE VOMER.

*Situation*.—Vertical, in the middle of the nasal fossæ. *Figure*.—Thin, irregularly quadrilateral, divided into two faces and four edges. *Lateral faces*.—Forming a part of the internal wall of the nasal fossæ. *Superior edge*.—Divided by a groove into two plates, articulating with the sphenoid. *Inferior edge*.—Lodged in the fissure formed by the superior maxillary and palate bones. *Posterior edge*.—Separating the posterior openings of the nasal fossæ. *Anterior edge*.—Presenting a deep fissure, which receives, superiorly, the vertical plate of the ethmoid bone, and inferiorly, the cartilage of the septum narium. *Development*.—In the fœtus of four months we find a single bone, composed of two plates, of equal thickness in every part.

## INFERIOR MAXILLARY BONE.

*Situation.*—At the inferior part of the face. *Form.*—Symmetrical, parabolical; convex anteriorly; concave posteriorly, divided by anatomists into the body, which is horizontal, and into the branches, which are vertical; it is divided into two faces and three borders.

*External face.*—We observe here, 1st, On the middle line, the symphysis. 2d, Laterally and from before backward, a superficial depression for the insertion of the levator menti muscle; more outwardly, the *mental foramen*, for the vessels and nerves of the chin; the *external oblique line*, terminating posteriorly at the anterior edge of the coronoid process, giving attachment to the depressores anguli oris labii que inferioris, and to the platysma myoides; posteriorly, the external surface of this bone, which is quadrilateral, and covered by the masseter muscle, which is fixed to its lower border.

*Internal face.*—It presents, 1st, On the middle line, the trace of the symphysis of the chin; the four processes giving attachment, the superior to the genio-glossi, the inferior to the genio-hyoidei muscles. 2d, Laterally, and from before backward, a depression for the sublingual gland; a rough depression for the attachment of the digastricus or *mylo-hyoideus* muscle; the internal oblique line, prominent, directed backward and upward, giving attachment anteriorly to the mylo-hyoid muscles, posteriorly to the superior constrictors of the pharynx; posteriorly, and beneath this line, a depression for the submaxillary gland, and a groove which receives a nerve; altogether posteriorly, and in the middle of the internal face of the ramus, the *orifice of the inferior dental canal*, traversed by the vessels and nerve of the same name; inferior to this, the surface is uneven, for the insertion of the internal lateral ligament of the lower jaw, and beneath this are inequalities for the insertion of the internal pterygoid muscle.

*Inferior border.*—It is named the base of the lower jaw, and is thick and rounded, giving attachment to the platysma myoides; presenting posteriorly a depression for the facial artery. *Superior border.*—Excavated by sixteen conical cavities, separated by septa, and destined to receive the roots of the inferior teeth; topped posteriorly by the *coronoid process*, a triangular eminence, giving attachment, anteriorly and inferiorly, to the buccinator muscle, and by its summit to the temporalis muscle. *Posterior border.*—Nearly vertical, forming, with the inferior, the angle of the lower jaw, to the external part of which is attached the masseter muscle, to the internal the pterygoid, and to the posterior, between these two muscles, the stylo-maxillary ligament. It corresponds to the parotid gland; it terminates superiorly by the condyle, a transverse eminence, articulating with the glenoid cavity of the temporal bone, and supported by a neck, giving attachment anteriorly to the external pterygoid muscle, and exteriorly to the external lateral ligament, and separated anteriorly from the coronoid process by the *sigmoid notch*, through which pass the masseteric vessels and nerves. *Development.*—In the earliest periods, this bone is formed of two lateral pieces, united on the median line by cartilage.

#### THE TEETH.

*Conformation.*—In number thirty-two, sixteen in each jaw, implanted in their alveoli, of an irregular conoidal figure; they present three parts, one exterior, named the *crown*; one interior, concealed in the alveole, and termed the *root*; and a middle portion, separating the former ones, termed the *neck*. They are divided into three classes; *incisors*, *canine*, and *molars*. *Structure.*—The root and centre of the crown are formed of hard, compact, osseous tissue, of the same nature as that of the other bones. The crown is composed of *enamel*, a white, brilliant, smooth substance, excessively hard, and arranged in fibres. The summit of each root presents the ori-

fice of a canal, which leads into the cavity filled by a soft substance, termed the pulp, in which are observed nervous filaments and vascular branches—1st, *Incisors*.—*Situation*.—At the anterior and middle part of the jaws, four in number on each side. *Form*.—Their crown is cuneiform, convex anteriorly, and concave posteriorly; thin and cutting on the free border, triangular on the sides which correspond to the other teeth. Their root is elongated, conical, and flattened transversely. The superior incisors are larger than the inferior. 2d, *Canine*.—*Situation*.—On each side of the incisors, in number four, two in each jaw. *Form*.—Crown conical; convex anteriorly, concave behind; summit blunt, separated from the neck by two curved lines. Their root is simple and conical, very long and grooved, and flattened on the sides. 3d, *Molars*.—*Situation*.—At the posterior part of the alveolar border; in number twenty, ten in each jaw, five on each side, divided into four small molars, and six large behind the former. *Form*.—The crown of the small molars is flattened anteriorly and posteriorly where it touches the other teeth, but rounded on the inner and outer sides; capped with two tubercles, the one internal, the other external and largest, and provided each with small points, separated from one another by two small depressions. Their neck is circular. Their root simple, sometimes bifurcated. The crown of the large molars is cubical, and contiguous, anteriorly and posteriorly, with the neighbouring teeth. Their root is divided into two, three, four, and even five diverging branches, each perforated at their summits by a small hole.

#### THE OS HYOIDES.

*Situation*.—At the anterior and middle part of the neck, between the base of the tongue and the larynx. *Form*.—Parabolical, convex anteriorly, concave posteriorly; composed of five pieces; the body, and the greater and lesser cornua. *Body, or central portion*.—Its *anterior face* presents a horizontal line, and two



depressions separated into two parts by a crest; this surface gives attachment, from below upward, to the digastric, stylo-hyoid, mylo-hyoid, genio-hyoid, and hyo-glossal muscles. Its *posterior face* is concave, and separated from the epiglottis by cellular tissue. Its lower edge receives the insertion of the sterno-hyoid, omo-hyoid, thyro-hyoid muscles, and in the centre of the thyro-hyoid membrane. Its upper edge gives attachment to the hyo-glossus. Its extremities are articulated with the great cornua. *Great cornua*.—Long and narrow; terminating posteriorly by a small rounded head; anteriorly by a face united to the body of the bone; their external surface gives attachment to the digastric and thyro-hyoid muscles; their internal is covered by the mucous membrane of the pharynx; their superior border gives attachment to the hyo-glossal muscles and middle constrictors of the pharynx; their inferior, to the insertion of the thyro-hyoid membrane. *Lesser cornua*.—Short, irregularly conical, inclined backward, giving attachment to some of the fibres of the genio-glossus and to the stylo-hyoidean ligament. *Development*.—These bones begin to ossify about the end of pregnancy, and sooner in the cornua than in the body.

#### IV. OF THE FACE IN GENERAL.

*Figure*.—The face is a species of triangular pyramid, truncated posteriorly, comprised in a triangular space, the superior side of which is formed by an uneven line, which separates the cranium from the face; the anterior side of which corresponds to the face, and the posterior side passes on the palatine arch. *Dimensions*.—The elevation of the face, measured by a line which would pass from the nasal prominence to the symphysis of the chin, gradually diminishes posteriorly; its breadth, more considerable in the superior than in the inferior third, also gradually diminishes from before backward. *Direction*.—The face is not vertical; it gradually inclines backward. This inclination, which varies in different people, is meas-



ured by the facial angle, formed by the meeting of the anterior and inferior sides of the triangle above mentioned, an angle which is, in general, about 80 degrees in the European head. The face is divided into six regions.

*Superior region.*—Blended with the cranium. *Inferior region.*—Divided into two parts, the one horizontal, the other vertical. The first, formed by the superior maxillary and palate bones, presents, 1st, On the median line, and from before backward, the inferior orifice of the anterior palatine canal; a suture, formed by the union of the maxillary bones anteriorly, and palate bones posteriorly, and the nasal spine. 2d, On each side, a concave surface, traversed by a suture, which unites the palatine process of the palate bone with the superior maxillary; the orifice of the posterior palatine canal. The vertical portion presents, in the middle and on the sides, the superior alveolar arch; the corresponding range of teeth; the opening of the mouth; the inferior alveolar arch, and the lingual face of the inferior maxillary bone. *Anterior, or facial region.*—Extending from above downward, from the superciliary ridge and nasal prominence, to the base of the inferior maxilla, and transversely from the external orbital process and malar bone of one side, to the same parts of the other. It presents, 1st, On the median line, and from above downward, the nasal prominence; a transverse suture, formed by the frontal and nasal bones; the nose, the two bones of which are united anteriorly by a suture, and posteriorly with the nasal process of the superior maxillary bone; the anterior opening of the nasal fossæ, triangular with its base below; the anterior nasal spine; the suture of the superior maxillary bones; lastly, the symphysis of the chin. 2d, On each side, and from above downward, this region presents the frontal prominence; the superciliary arch; the opening of the orbits, irregularly quadrilateral, presenting superiorly the supra-orbital foramen, inferiorly the articulation of the malar with the superior maxillary bone; on the outer side, the articulation of the for-

mer of these bones with the external orbital process, on the inner side that of the ascending process with the internal orbital. We next see the infra-orbital foramen; the canine fossa, bounded outwardly by an oblique suture, belonging to the malar and superior maxillary bones; lastly, the inferior maxillary bone.

*Posterior region.*—It extends transversely from the parotid border of the inferior maxilla to that of the opposite side, and vertically from the body of the sphenoid bone to the inferior wall of the nasal fossæ. It presents, 1st, On the median line, the articulation of the sphenoid with the vomer; the posterior border of the latter, which divides the posterior opening of the nasal cavity; the posterior nasal spine. 2d, On each side, the posterior opening of the nasal fossæ, which is quadrilateral, having the vertical extent greater than the transverse, bounded superiorly by the body of the sphenoid bone, which forms, in uniting to the sphenoidal process of the palate bone, the pterygo-palatine foramen, opening into the sphenomaxillary fossa; bounded inferiorly by the palatine bone; interiorly by the vomer, and exteriorly by the pterygoid process. We next see the pterygoid fossa, completed by the pyramidal process of the palate bone articulating with it; a space comprised between the pterygoid process and inferior maxillary bone, occupied by the external pterygoid muscle; and finally, the parotid edge of the inferior maxillary bone.

*Lateral regions.*—Each of these is bounded superiorly by the zygomatic arch and transverse crest of the temporal region of the sphenoid bone, and presents the branches of the inferior maxillary bone and the zygomatic fossa, a deep cavity, formed anteriorly by the maxillary tuberosity, and posteriorly by the external side of the pterygoid process. These osseous portions are separated by the *pterygo-maxillary* fissure, which is broad above, narrow below, and terminates in the latter direction by two small vertical sutures, uniting a thin plate of the palate bone anteriorly with the maxillary bone, posteriorly with the pterygoid process. Superiorly, this fissure meets, at a right angle, the

*spheno-maxillary* fissure, formed by the sphenoid bone superiorly, the maxillary inferiorly, the malar anteriorly, and the palate bone posteriorly. This angle of union leads into the *spheno-maxillary* fossa, which is placed behind and a little beneath the orbit, and formed by the palate bone internally, the sphenoid posteriorly, the superior maxillary anteriorly; presenting five foramina: viz., internally, the spheno-palatine, inferiorly the orifice of the palatine canal, posteriorly the superior maxillary, and the orifices of the vidian and pterygo-palatine canals.

## CAVITIES OF THE FACE.

### THE ORBITS.

They are two in number. *Figure*.—Symmetrical, of the form of a quadrangular pyramid, having the base anteriorly, the summit posteriorly. *Direction*.—Horizontal; their axes directed from before backward and from without inward. They are divided into four triangular surfaces, united by four re-entering angles. *Superior region*.—Formed by the orbital surface of the frontal bone and wing of Ingratius; presenting posteriorly a suture, which unites them and the optic foramen; anteriorly, the lachrymal fossa and depression for the reflection of the great oblique muscle of the eye. *Inferior region*.—Formed posteriorly by the anterior process of the superior border of the palate bone, in the middle by the superior maxillary, and anteriorly by the malar bone; presenting three sutures, which unite these bones, and which terminate in the sub-orbital canal. *External region*.—Formed by the sphenoid bone posteriorly, the malar anteriorly, presenting in the middle the suture of these two bones. *Internal region*.—Formed posteriorly by the sphenoid bone, in the middle by the ethmoid, anteriorly by the os unguis; presenting two lines, which indicate the union of these three bones; terminating anteriorly in the lachrymal groove, which gives origin to the nasal

canal, which latter is formed by the lachrymal bone and nasal process of the superior maxillary bone.

*Superior external angle.*—It presents posteriorly the sphenoidal fissure, and anteriorly the articulation of the frontal bone with the sphenoid and malar.

*Superior internal angle.*—Presenting the union of the frontal with the ethmoid and lachrymal bones; perforated by the internal orbital foramina.

*Inferior internal angle.*—Presenting the suture formed by the union of the palate bone and maxillary with the ethmoid and lachrymal bones.

*Inferior external angle.*—Presenting the speno-maxillary fissure posteriorly; formed anteriorly by the malar bone.

*Summit.*—Presenting the union of the sphenoidal, speno-maxillary, and pterygo-maxillary fissures. *Base.*—Already described.

#### THE NASAL FOSSÆ.

*Situation.*—At the middle part of the face; separated from one another by a septum, formed superiorly by the ethmoidal plate, posteriorly and inferiorly by the vomer, and anteriorly by a cartilage; divided each into four walls.

*Superior wall.*—It is concave, and formed anteriorly by the nasal region of the nasal bones; in the middle, by the ethmoidal grooves; posteriorly, by the sphenoid bone; presenting the sutures which unite these bones, and posteriorly, the opening of the two sphenoidal sinuses, separated by a middle plate.

*Inferior wall.*—Elongated from before backward, concave transversely, formed by the palatine processes of the superior maxillary and palate bones; presenting anteriorly the orifice of one of the branches of the anterior palatine canal.

*Internal wall.*—This is formed by the septum. *External wall.*—This is uneven, formed by the ethmoid, the palate, the superior maxillary, the inferior turbinated, and lachrymal bones; presenting from above downward the superior turbinated bone; the superior meatus, where we perceive, posteriorly, the speno-palatine hole, and anteriorly, the opening of the posterior ethmoidal

cells; the middle turbinated bone; the middle meatus, where is seen, posteriorly, the orifice of the maxillary sinus, and anteriorly, the opening of the anterior ethmoidal cells, one of which opens into the frontal sinus; lastly, the inferior turbinated bone and inferior meatus, presenting anteriorly the inferior orifice of the nasal canal.

## OF THE TRUNK.

The trunk, the central part of the body, is divided into the vertebral column, thorax, and pelvis.

### 1. THE VERTEBRAL COLUMN.

This bony framework occupies the posterior part of the trunk, extending from the head to the sacrum; it is composed of twenty-four bones, termed *vertebræ*, which are divided into the *cervical*, *dorsal*, and *lumbar*, according to their situation.

### OF THE VERTEBRÆ IN GENERAL.

*Form.*—Symmetrical. Each vertebra presents, 1st, on the median line, and from before backward, the *body*, a thick convex portion, concurring posteriorly to form the vertebral canal, united superiorly and inferiorly to the intervertebral fibro-cartilages; the *vertebral foramen*; the *spinous process*, a more or less prominent eminence, which is directed posteriorly, and is continuous anteriorly, with the two vertebral plates. 2d, Laterally, the two *transverse processes* turned outward; the four *articulating processes*, two superior and two inferior, articulating with those of the other vertebræ; the four notches, more or less well marked, forming the holes of conjugation by their union with those of the superior and inferior vertebræ.

1. *Cervical vertebræ.*—*Conformation.*—Smaller than the others; seven in number, named in their numerical order, counting from above downward, except the first, which is termed the *atlas*, and the second

the *axis*. The *body* of these vertebræ is elongated transversely, concave superiorly, convex inferiorly; the foramen is larger than in the other regions, and triangular; the *spinous process* is horizontal, short, and bifurcated; the plates are longer and narrower than in the other regions; the *transverse processes* are short, bifurcated at their summit, presenting superiorly a groove, the borders of which receive the insertion of the intertransverse muscles of the neck, and at their base a foramen traversed by the vertebral artery; the *inferior articulating processes* are oval, directed forward and downward; the superior are directed backward and upward; the *notches* are placed in front of the articulating processes.

2d. *The dorsal vertebræ.*—*Conformation.*—They are in number twelve; named in numerical order, counting from above downward. The *body* is greater in extent from before backward than transversely, thicker posteriorly than anteriorly, flattened superiorly and inferiorly, very convex anteriorly, presenting on each side, in the greater number of the vertebræ, two semicircular surfaces, articulating with the head of the ribs; the foramen is of less diameter than in the neck, and is oval from before backward; the *spinous processes* are long, prismatic, and triangular, tuberculated at their summit, and inclining downward; the *plates* are broad and thick; the *transverse processes* are large and long, terminated by a tubercular summit, provided with an articulating surface for the tuberosity of the ribs; the *superior articular processes* are vertical, directed backward; the inferior ones are directed forward; the notches are larger than those in the neck, and are placed behind the articulating processes.

3d. *Lumbar vertebræ.*—*Conformation.*—Volume very considerable; the *body* is very large, of greater extent transversely than in any other direction, thicker anteriorly than posteriorly, flat superiorly and inferiorly; the foramen is triangular, of greater diameter than in the dorsal vertebræ; the *spinous process* is broad, flattened transversely, horizontal, quadrilateral; the

*plates* are thick and short; the *transverse* processes are long and horizontal; the articular processes are very large and prominent; the superior are concave, directed inward; the inferior are convex, directed outward; the notches are very large.

4th. Three vertebræ in the neck possess peculiar characters.

1st. *Atlas, or first vertebra.*—*Form.*—That of an irregular ring, presenting, 1st, in the middle, and from before backward, a small arch, convex and tuberculous anteriorly, concave posteriorly, with an articulating surface for the odontoid process of the axis, thin superiorly and inferiorly; the *vertebral foramen* very large, divided in the recent state into two parts by a ligament; another arch, larger than the former, tuberculated posteriorly, where the posterior recti muscles of the head are attached, concave anteriorly, hollowed superiorly and in front by a groove for the vertebral artery and sub-occipital nerve, inferiorly and in front by a similar groove for the second cervical nerve; 2d, It presents on the sides the *articular* processes, which are horizontal and broad, the *superior* concave, articulating with the occipital bone, the inferior plane, united to the axis; the transverse processes, which are long, arise by two roots.

2d. *The axis, or second vertebra.*—*Form.*—Circumference nearly triangular; the *body* of greater extent vertically than transversely, presenting anteriorly a crest, and two lateral depressions for the longus colli muscles; superiorly, the odontoid process, a vertical eminence, articulating anteriorly with the atlas, posteriorly gliding on the transverse ligament, receiving on its summit the insertion of the odontoid ligaments; the vertebral foramen is triangular: the *spinous* process is broad, and grooved inferiorly; the plates are very thick; the transverse processes are very short, and not bifurcated; the superior articulating processes are nearly horizontal and convex; the inferior are turned forward and downward.

3d. *The seventh vertebra.*—The spinous process is very long, prominent, and not bifurcated.



In the dorsal region, four vertebræ present some peculiarities.

1st, *The first dorsal vertebra.*—The *body* is of greater extent transversely than from before backward, presenting on its sides a complete articulating surface superiorly, and a semiface inferiorly; the spinous process is long, tuberculous, and nearly horizontal. 2d, *The tenth dorsal vertebra.* There is only one entire articulating surface on each side of the body for the tenth rib. 3d, *The eleventh dorsal vertebra.*—On each side of the body is one entire articulating surface for the eleventh rib; the spinous process is horizontal; the transverse processes are not articular at their summit. 4th, *The twelfth dorsal vertebra.*—The same characters as the preceding.

In the lumbar region, one vertebra differs from the rest, viz., the *fifth*; its body on its inferior surface is cut obliquely from before backward, and from below upward; is much thicker anteriorly than posteriorly, and is articulated below with the sacrum.

## II. OF THE VERTEBRAL COLUMN IN GENERAL.

*Length.*—It forms about the third of the total length of the body. *Direction.*—Curved in its three regions; anteriorly, it is concave in the neck, convex in the back, and concave in the loins; posteriorly, these curves are the inverse. *Form.*—That of an irregular truncated pyramid, the base below, the apex above; divided into four faces, one base, one apex, and one canal.

*Anterior face.*—This presents a number of transverse grooves, separated by prominent borders; covered by the anterior vertebral ligament; in the cervical region it corresponds to the recti capitis antici majores, and longi colli muscles; in the dorsal region, to these muscles, with the vena azygos on the right, and aorta on the left; in the lumbar region to the pillars of the diaphragm, the abdominal aorta, the inferior vena cava, and the ganglia of the lumbar nerves.

*Posterior face.*—It presents in the median line the spine, or the series of spinous processes, horizontal in



the neck and loins, inclined downward on the dorsal region; on the sides, the vertebral grooves, formed by the vertebral plates, and filled by the sacro-lumbar muscles, the longissimus dorsi, and multifidus spinæ muscles.

*Lateral surfaces.*—Presenting the series of transverse processes, pierced at their base by the foramen which receives the vertebral artery; articulating in the dorsal region by their summit with the ribs. Between these processes we see the holes of conjugation, formed by the union of the vertebral notches, and traversed by the vertebral nerves; in front of these foramina is the series of articulating surfaces for the ribs.

*Base.*—Broad and oblique backward and upward, articulating with the sacrum. *Summit.*—Articulating with the occipital bone.

*Vertebral canal.*—Triangular in the cervical and lumbar regions, circular in the dorsal, communicating superiorly with the cavity of the cranium, continuous below with the sacral canal; it is occupied by the spinal marrow and its membranes.

### III. THE THORAX.

This is a conoid cavity, containing the heart and lungs; occupying the anterior and superior part of the trunk; formed by the sternum anteriorly, and by the ribs on the sides.

#### THE STERNUM.

*Form.*—Symmetrical, flattened from before backward, elongated, directed obliquely downward and forward, divided into two faces, two edges, and two extremities.

*Anterior face.*—Covered by the integuments and aponeuroses of the pectoralis major and sternocleido-mastoideus muscles; presenting four more or less prominent transverse lines, indicating its division into different portions at early life.

*Posterior face.*—Its middle part corresponds to the

anterior mediastinum; giving attachment laterally to the triangularis sterni, and superiorly to the sterno-hyoid and sterno-thyroid muscles.

*Lateral edges.*—Presenting seven articulating cavities, united with the cartilages of the true ribs, and separated from one another by notches.

*Superior extremity.*—Thick, notched in the middle, where the interclavicular ligament is found; hollowed laterally for the articulation with the clavicle.

*Inferior extremity.*—Terminating in the xiphoid cartilage, a prolongation varying in form and extent, and to the sides of which some of the superior fibres of the transversalis muscle are inserted, as also the aponeurosis of the abdominal muscles; to its anterior surface is fixed the costoxiphoid ligament.

#### THE RIBS.

*Conformation.*—Twelve in number on each side, named in numerical order, counting from above downward; they are irregular, elongated, semicircular, concave on the inner side, convex on the outer, twisted, and of a variable length; they are directed, the superior horizontally, the others are more inclined downward, according as they are more inferior; they are divided into seven true ribs and five false; they consist of a body and two extremities.

*Body.*—Its external face presents posteriorly a tuberosity, articulating with the transverse process of the dorsal vertebræ by its internal portion, and receiving, by the external, the insertion of the posterior transverse ligament; more anteriorly is the angle of the ribs, a prominent line, looking obliquely outward and downward; between the tuberosity and angle is a rough surface for the insertion of the lumbo-costalis muscle; in front of the angle is a surface covered by different muscles. *Internal surface.*—Concave, covered by the pleura. *Superior border.*—Giving attachment to the two sets of intercostal muscles. *Inferior border.*—Presenting a groove on the inner side for the intercostal vessels and nerves.

*Development.*—The ribs are developed very early, and are seen at the beginning even of the third month of pregnancy. They arise from three points of ossification.

*Posterior extremity.*—Articulating with the bodies of the dorsal vertebræ by a small head, provided with two surfaces, and supported by a neck for the insertion of the middle costo-transverse ligament.

*Anterior extremity.*—Provided with a small cavity for the insertion of the costal cartilages.

Four of the ribs present a few particular characters.

1st, *First rib.*—This is shorter, broader than the rest, and transverse; its superior face presents two depressions for the subclavian artery and vein; an impression for the insertion of the anterior scalenus muscle, and it has no angle; its inferior face is a little convex; its internal is concave and thin; its external border is convex, and presents a tuberosity; its vertebral extremity has but one articulating surface; the inferior costo-transverse ligament is wanting. 2d, *Second rib.*—This is horizontal; its external surface presents a rough impression for the insertion of the serratus magnus muscle; its angle scarcely exists; its internal surface presents a small groove posteriorly. 3d, *Eleventh rib.*—This has no tuberosity, and consequently no relation with the transverse process of the corresponding vertebra; it is without a groove; the angle is little marked; the head has one articulating surface. 4th, *Twelfth rib.*—Very short, but slightly curved, without a tuberosity, angle, or groove; and without the inferior costo-transverse ligament.

#### THE COSTAL CARTILAGES.

*Conformation.*—Twelve in number on either side, placed at the anterior part of the thorax, between the sternum and ribs, varying in length, diminishing progressively in breadth from above downward, divided into a body and two extremities.

*Body.*—Covered anteriorly by the pectoralis major, obliquus externus, and rectus abdominis muscles; the first cartilage is covered by the subclavius muscle, and costo-clavicular ligament, which is attached to it; it is in relation posteriorly with the pleura, the triangularis sterni, the transversalis, and diaphragm. The edges give attachment to the intercostal muscles; the superior border of the sixth to the pectoralis major; the sixth, seventh, and eighth cartilages are articulated together by their corresponding edges.

*External extremity.*—This is intimately united to the corresponding rib. *Internal extremity.*—That of the cartilage of the true ribs is articulated with the sternum by a convex surface; that of the cartilages of the first three false ribs is united to the cartilage which is superior; in the last two ribs it is isolated.

#### IV. OF THE THORAX IN GENERAL.

*Form.*—That of a truncated cone, the base of which, situated inferiorly, is cut obliquely from above downward, and from before backward; its axis is directed downward and forward. *Dimensions.*—The diameters increase, in proportion as we examine it more inferiorly; the transverse diameters are greater than the antero-posterior.

*Exterior surface.*—Its *anterior* region, directed forward and downward, presents in the middle the cutaneous face of the sternum and ensiform cartilage; laterally, the costal cartilages, and the intercostal spaces occupied by the muscles of the same name. Its *posterior* region presents on the median line the spinous processes; laterally, and from within outward, the two vertebral grooves, the series of transverse processes articulating with the tuberosity of the ribs; and, finally, a line formed by the angle of the ribs running downward and outward. Its *lateral* regions are very convex, and present the external face of the ribs and the intercostal spaces, filled by the muscles of the same name.

*Internal surface.*—Presenting at its *anterior* region the posterior face of the sternum and costal cartilages; at its *posterior* region, the prominence of the bodies of the vertebræ; and laterally, two deep depressions, which lodge the posterior borders of the lungs at its lateral regions, which are very concave; the inner face of the ribs.

*Superior circumference.*—Transversely oval, formed by the vertebral column, sternum, and first rib, traversed by the trachea, œsophagus, arteries, veins, and nerves, which pass from the thorax to the superior extremities and head, or which descend from these parts into the chest.

*Inferior circumference, or base.*—Of considerable extent transversely; it is formed anteriorly by the ensiform cartilage, laterally by the costal cartilages; it gives attachment to the muscles of the abdomen, particularly to the transversalis; also to the diaphragm.

## V. OF THE PELVIS.

The pelvis is a large irregular cavity, open superiorly and inferiorly, terminating the trunk; it contains a part of the intestines, and the urinary and genital organs; it is supported by the femoral bones, and is formed by four bones, viz., posteriorly and in the middle by the sacrum and os coccygis; laterally by the ossa ilia.

### OS SACRUM.

*Situation.*—At the posterior part of the pelvis, beneath the vertebral column. *Figure.*—Pyramidal and triangular, flattened from before backward. *Direction.*—Vertical; divided into four faces, a base, and apex.

*Posterior face.*—We observe here, 1st, On the median line, four or five eminences, short and horizontal, often united together, forming a continuation of the spinous processes of the vertebræ; beneath these, a triangular groove, the termination of the sacral canal,

completed posteriorly by the posterior sacro-coccygeal ligament, bounded laterally by two tubercles, beneath which lie the grooves traversed by the last sacral nerve. 2d, On the sides are two superficial grooves, pierced by the four posterior sacral foramina for the passage of the posterior branches of the sacral nerves; more outwardly is a series of eminences, corresponding to the articular processes of the vertebræ; beneath the foramina are two depressions for the insertion of the sacro-iliac ligaments.

*Anterior face.*—It presents four transverse and prominent lines, indicating the junction of the different pieces of which it is composed during infancy; laterally, the four anterior sacral foramina, traversed by the anterior branches of the sacral nerves; on the outer side of these foramina, a concave surface, for the attachment of the pyramidalis muscle, and which is marked by transverse grooves for the several nerves.

*Lateral, or iliac faces.*—Presenting anteriorly a broad, irregular, and rough surface, of an oval form, articulating with the ossa ilia; in the rest of its extent, inequalities for the insertion of the sacro-iliac ligaments; inferiorly, a small notch for the passage of the fifth pair of sacral nerves.

*Base.*—We observe, 1st, In the middle, and from before backward, an articular face of greater extent transversely than from before backward, directed obliquely, and united to the last lumbar vertebra; the orifice of the sacral canal, which is triangular, and gives attachment by its edges to the last yellow ligaments. 2d, Laterally, a concave surface, elongated transversely, covered by the anterior sacro-iliac ligaments, and continuous with the iliac fossa; an articular process, directed backward and inward, articulating with the inferior one of the last lumbar vertebræ.

*Apex.*—Directed downward, presenting an oval surface, uniting with the os coccygis.

*Development.*—In the fourth month of pregnancy we see the bodies, and then the lateral masses of the

false sacral vertebræ. The number of osseous nuclei in the sacrum is twenty-one.

## OS COCCYGIS.

*Situation.*—At the posterior and inferior part of the pelvis, under the sacrum. *Form.*—Symmetrical, triangular, formed of three or four small bones united by fibro-cartilages, and divided into two faces, two edges, one base, and one apex. *Posterior, or spinal face.*—Convex, giving attachment to the aponeurosis of the glutæi muscles, and posterior sacro-coccygeal ligament. *Anterior surface.*—Concave, covered by the anterior sacro-coccygeal ligament. *Lateral edges.*—Receiving the insertion of the anterior sacro-sciatic ligaments and ischio-coccygeus muscle. *Base.*—Presenting anteriorly an oval surface, articulating with the summit of the sacrum; posteriorly, two tuberculous eminences, often united to the sacrum, termed the cornua of the coccyx; two eminences, marked by the passage of the fifth pair of sacral nerves. *Apex.*—Giving attachment to the levator ani muscle.

*Development.*—In the full-grown fœtus the first coccygeal bone generally contains an osseous nucleus. The others do not ossify till the seventh year.

## OSSA INNOMINATA.

*Situation.*—At the lateral and anterior parts of the pelvis. *Form.*—Irregular, broad, curved in two different directions, contracted in its middle portion; divided into two faces and four edges.

*External, or femoral face.*—Divided into two parts. The posterior part is directed outward, is concave and convex alternately, and is termed the *external iliac fossa*; it presents posteriorly a small uneven surface for the insertion of the glutæus maximus muscle; in front of this latter the *superior curved line*; beneath this line a concave surface for the attachment of the glutæus medius muscle; more infe-

riorly, the *inferior curved* line; next, a broad convex surface, for the attachment of the glutæus minimus muscle, and also we observe, anteriorly, inequalities for the curved tendon of the rectus femoris. The anterior part presents inferiorly the cotyloid cavity, which is hemispherical, about two inches in diameter, directed outward and forward, and articulates with the head of the femur; it is surrounded by a prominent border, which is notched anteriorly for the passage of the vessels of the articulation; in front of, and beneath this cavity, is the obturator foramen, a large opening, oval in the male, triangular in the female, giving attachment by its circumference to a fibrous membrane, which shuts in the foramen except superiorly, where there exists a groove for the passage of the obturator vessels and nerves; on the inner side of this foramen is a smooth surface, for the attachment of the adductor muscles of the thigh and obturator externus; on the outer side is a groove for the tendon of the obturator internus muscle.

*Internal, or abdominal face.*—Divided into two parts, like the external. The posterior part, directed inward, presents posteriorly prominent inequalities for the attachment of the sacro-iliac ligaments; a broad articulating surface, united with the sacrum; all the rest of the superior part of this surface is termed the iliac fossa, and is occupied by the iliacus muscle. The anterior part presents superiorly a line which separates it from the posterior, and makes part of the superior strait of the pelvis; beneath this is a surface covered by the obturator internus and levator ani muscles; the obturator foramen; and, on the inner side, a surface which corresponds to the bladder.

*Superior edge.*—Thick, convex, sigmoid shaped, giving attachment on the outer side to the latissimus dorsi and external oblique muscles, and to the crural aponeurosis; on the inner side, to the transversalis and quadratus lumborum muscles; and in the interval, to the obliquus internus muscle.

*Inferior edge.*—Articulating by its superior third with that of the opposite side, to form the symphysis



pubis ; by its two inferior thirds contributing to form the pubic arch, and on the outer side giving attachment to the gracilis and adductores femoris ; on the inner, to the corpus cavernosum, transversus perinæi, and erector penis muscles.

*Posterior edge.*—Presenting, at its union with the superior border, the *postero-superior* iliac spine ; afterward, from above downward, the *postero-inferior* spine ; the great sciatic notch, which contributes to form the hole of the same name ; the sciatic spine, a prominent eminence, triangular, giving attachment on the outer side to the superior gemellus, on the inner side to the coccygeus, by its summit to the anterior sacro-sciatic ligament ; the lesser sciatic notch, occupied by the tendon of the obturator internus ; and finally, the ischiatic tuberosity, giving attachment on the outer side to the quadratus femoris and great adductor, on the inner side to the inferior gemellus and posterior sacro-sciatic ligament ; the middle to the biceps, the semi-tendinosus, and semi-membranosus muscles.

*Anterior edge.*—Presenting, at its union with the superior, the *antero-superior spinous* process of the ilium, giving attachment on the outer side to the tensor vaginæ femoris ; on the inner side to the iliacus internus ; in the middle to the obliquus abdominis externus and sartorius ; the *anterior-inferior spinous* process, for the attachment of one of the tendons of the rectus femoris ; a groove for the tendon of the psoas and iliacus muscles ; the *ilio-pectineal* eminence for the attachment of the psoas minor ; a triangular horizontal surface, which receives the insertion of the pectineus muscle ; finally, the *spine of the pubis*, where the external pillar of the abdominal ring and the pyramidalis muscles are attached.

*Development of the bone.*—During the first periods of life, this bone is composed of three pieces : one superior, named the *ilium* ; one anterior, the *pubis* ; and one inferior, the *ischium*.

## VI. OF THE PELVIS IN GENERAL.

It is divided into two surfaces and two circumferences.

*External surface.*—Its *anterior* region presents in the middle the symphysis pubis; on the sides, the surfaces of insertion of the adductor muscles, the obturator foramina, and the acetabula. Its *posterior* region presents on the median line the spinous processes of the sacrum, the termination of the sacral canal, the articulation of the sacrum with the coccyx, the spinal surface of this latter bone; on the sides, the posterior sacral foramina, the attachments of the sacro-iliac ligaments, a fissure between the sacrum and ilium, and the posterior iliac tuberosities. Its *lateral* regions present the external iliac fossæ, the margin of the cotyloid cavity, the great sciatic notches.

*Internal surface.*—Divided into two parts by a prominent line, circumscribing the space termed the *superior strait of the pelvis*, the transverse diameter of which is greater than the antero-posterior, and oblique. The superior part, termed the *greater pelvis*, presents posteriorly the *sacro-vertebral* angle, formed by the union of the sacrum with the vertebral column; on the sides, the iliac fossæ; and anteriorly, a broad notch. The inferior part, termed the cavity of the pelvis, forms a species of canal, contracted at its extremities, and presenting posteriorly the concave surface of the sacrum; anteriorly, the symphysis pubis, two surfaces corresponding to the bladder and obturator foramina; laterally, the sciatic notches, and a part of the sacro-iliac articulations.

*Superior circumference, or base of the pelvis.*—It presents posteriorly the sacro-vertebral angle; anteriorly, the notch filled by the psoas and iliacus muscles; on the sides, the crista ilii.

*Inferior circumference.*—It presents three considerable notches, separated by osseous eminences; one anterior, termed the *pubic arch*, formed by the inferior

borders of the ilium, terminating superiorly in a very acute angle in man, more obtuse in women, and occupied by the genital organs in both sexes; the two other lateral notches, placed between the ischiatic tuberosities and sacrum, are named the *great sciatic notches*, traversed by the pyramidal muscles, the sciatic, the gluteal, and internal pudic vessels and nerves, also by the tendon of the internal obturator muscle.

## OF THE EXTREMITIES.

They are four in number, disposed in pairs, and divided into the superior, or thoracic, and inferior, or abdominal.

### 1. THE SUPERIOR, OR THORACIC EXTREMITIES.

They are fixed to the superior and lateral parts of the trunk, and are divided into four parts, viz.: the shoulder, arm, fore-arm, and hand.

#### OF THE SHOULDER.

This is situated on the upper and lateral parts of the trunk, and it is formed by the clavicle anteriorly, and scapula posteriorly.

#### CLAVICLE.

*Situation.*—At the superior and anterior part of the chest. *Figure.*—A long, irregular bone, twisted like an italic S, directed transversely, divided into a body and two extremities. *Body.*—Its superior face gives attachment to the sterno-mastoid muscle; its inferior face presents, on the inner side, inequalities for the insertion of the costo-clavicular ligament; in the middle is a groove, occupied by the subclavius muscle; on the outer side a prominent crest, for the insertion of the coraco-clavicular ligaments. Its anterior border receives on the inner side the insertion of the pectoralis major, on the outer that of the del-

toid muscle. Its posterior border gives attachment on the outer side to the trapezius muscle. *Internal extremity.*—This presents a triangular, uneven surface, for the articulation with the sternum. *External extremity.*—Articulating with the acromial process by a narrow surface.

*Development.*—The clavicle appears very early, and in the middle of the second month of pregnancy it is four times as large as the humerus. It arises by one point of ossification.

#### SCAPULA.

*Situation.*—At the superior and posterior part of the thorax. *Form.*—Irregular, thin, flattened from before backward, triangular, divided into two faces and three edges. *Posterior face.*—Divided superiorly into two parts by the spine of the scapula, a triangular eminence, directed transversely, and flattened from above downward. This process terminates posteriorly by a thick border, which presents on the inner side a small surface, on which glides the aponeurosis of the trapezius, and gives attachment in the rest of its extent superiorly to the same muscle, inferiorly to the deltoid. It is terminated exteriorly by a concave edge, which forms, at its union with the preceding edge, the acromion process, an eminence of considerable size, flattened in a contrary direction to that of the spine; covered on the outer side by the skin; corresponding on the inner side to the supra-spinatus muscle; giving attachment superiorly to the trapezius muscle, and articulating with the clavicle by a small surface; receiving inferiorly the insertion of the deltoid. Above the spine we observe the supra-spinatus fossa, occupied by the muscle of the same name, to which it gives attachment; underneath, the infra-spinatus fossa, filled by the muscle of the same name, presenting on the outside a longitudinal crest, where the aponeurosis common to the infra-spinatus, and teres major and minor muscles, is inserted; between this crest and the ax-

illary border of the scapula is a narrow and elongated surface, divided by another crest into two parts, the superior of which gives attachment to the teres minor, and the inferior to the teres major muscle.

*Anterior, or costal surface.*—This is concave, is termed the sub-scapular fossa, being occupied by the muscle of the same name, the aponeurotic fibres of which are fixed to its two internal thirds and to the prominent lines which it presents. It gives attachment posteriorly by two surfaces, one superior, the other inferior, to the serratus magnus muscle.

*Superior edge.*—This gives attachment posteriorly to the supra-spinatus muscle; anteriorly to the sub-scapularis; in the middle to the omo-hyoideus; presenting on the outside a notch, which is formed into a foramen by a ligament, and traversed by the supra-scapular nerve; terminating exteriorly by the coracoid process, an elongated, curved eminence, giving insertion superiorly to the coraco-clavicular ligaments, anteriorly to the pectoralis minor, posteriorly to the coraco-acromian ligament, exteriorly and at its summit to the biceps and coraco-brachialis muscles.

*Internal, or vertebral edge.*—Termed the base of the scapula; it gives attachment posteriorly to the supra and infra spinatus muscles, anteriorly to the serratus magnus, in the middle to the rhomboideus, and forms, with the superior border, the posterior angle, in which is inserted the levator anguli scapulæ.

*External edge, or side of the scapula.*—Marked superiorly by a small groove, where the long portion of the triceps brachialis is attached; presenting posteriorly inequalities for the attachment of the teres minor muscle; giving attachment anteriorly to the sub-scapularis muscle, inferiorly to the teres major; forming, with the internal border, the *inferior angle*, into which the latter muscle is implanted, and some fibres of the latissimus dorsi; presenting, at its union with the superior border, the *glenoid* cavity, superficial and oval, surrounded by a fibro-cartilaginous margin; articulating with the head of the humerus, giving attachment superiorly to the tendon of the long portion

of the biceps muscle, supported by a narrow neck, in which the fibrous capsule of the articulation is inserted.

*Development.*—The scapula first appears towards the end of the second month as a flat bone: the spine does not appear till the third month.

#### OF THE ARM.

This is formed of a single bone, named the humerus.

#### HUMERUS.

*Situation.*—Between the scapula and fore-arm.  
*Form.*—Irregular, long, cylindrical, divided into a body and two extremities. *Body.*—Rounded superiorly, prismatic inferiorly. Its *internal* face presents, superiorly, the bicipital groove, through which glides the tendon of the long portion of the biceps, and which gives attachment by its posterior border to the tendons of the latissimus dorsi and teres major muscles, and by its anterior to the pectoralis major; towards the middle the foramen for the vessels of the bone, and inequalities for the insertion of the coracobrachialis muscle; inferiorly it gives attachment to the brachialis internus. Its *external* face presents, superiorly, a very superficial depression for the passage of the radial nerve; at its superior third the impression of the deltoid muscle. This face is covered inferiorly by the brachialis internus. Its posterior face is covered by the triceps brachialis, to which it gives attachment. The external edge is traversed about the middle by a depression for the passage of the radial nerve; it gives insertion inferiorly to the supinator radii longus, brachialis internus, radialis longior, and triceps muscles, and to an intermuscular aponeurosis. The internal edge receives superiorly the insertion of the triceps, in the middle that of the coracobrachialis, and inferiorly that of the brachialis internus, triceps, and an aponeurosis. The anterior

edge is interrupted superiorly by the impression of the deltoid, and gives attachment inferiorly to the brachialis internus muscle. *Superior extremity.*—Formed of three eminences, one internal, nearly hemispherical, directed inward, termed the head of the humerus, supported by a neck, and articulating with the glenoid cavity of the scapula; the two others are termed the greater and lesser tuberosities, situated externally; one posterior, more voluminous, presenting three surfaces, into which are inserted, from before backward, the supra-spinatus, infra-spinatus, and teres minor muscles; and the other anterior, smaller, to which is fixed the sub-scapularis muscle.

*Inferior extremity.*—Of greater extent transversely than from before backward; it presents inferiorly, and from without inward, the *external condyle*, an eminence to which the external lateral ligament of the articulation of the elbow is fixed, as are also the radialis brevior, extensor communis digitorum, extensor minimi digiti, ulnaris, anconeus, and supinator brevis muscles; the *lesser condyle*, a rounded eminence, articulating with the radius; a groove which receives the border of the extremity of this latter bone; a semi-circular crest, lodged between the radius and ulna; a pulley, articulating with the sigmoid cavity of the ulna; and finally, the *internal condyle*, more prominent than the external, giving attachment to the internal lateral ligament of the articulation, and receiving the insertion of the common tendon of the pronator teres, radialis internus, palmaris longus, ulnaris internus, and flexor sublimis muscles. This extremity presents superiorly, and above these depressions and eminences, a cavity which is filled by the coronoid process in the flexion of the fore-arm, and a depression which receives the border of the superior extremity of the radius; superiorly and posteriorly, a deep depression, which lodges the olecranon in the movements of extension. *Development.*—The humerus begins to form about the middle of the second month of pregnancy, by two points of ossification.



## OF THE FORE-ARM.

This is formed of two bones, one which is external, termed the *radius*, the other internal, named the *ulna*, or *cubitus*.

## THE RADIUS.

*Form.*—Long, irregular, triangular in the middle, a little curved inward, divided into a body and two extremities. *Body.*—Prismatic. Its *anterior* face presents superiorly the foramen for the vessels of the bone, gives attachment to the flexor longus pollicis manus, and entirely inferiorly to the pronator quadratus. Its *posterior* face is covered superiorly by the supinator radii brevis, gives attachment at its centre to the abductor pollicis longus and extensor minor pollicis muscles, and is covered inferiorly by the extensor communis digitorum, extensor proprius pollicis, and extensor major muscle. Its external surface receives superiorly the insertion of the supinator brevis; in the middle, the pronator teres. Its posterior edge presents nothing remarkable. Its anterior edge gives insertion superiorly to the superficial flexors, the flexor pollicis longus, and supinator brevis muscles; inferiorly to the supinator longus and pronator quadratus.

*Superior extremity.*—Presenting superiorly a circular cavity, articulating with the small condyle of the humerus. Its circumference articulates on the inner side with the small sigmoid cavity of the ulna, and is united on the outside with the annular ligament. This extremity is supported by a neck, which terminates inferiorly in the bicipital tuberosity to which the biceps muscle is attached.

*Inferior extremity.*—Quadrilateral; presenting, 1st, Inferiorly, a superficial cavity, divided by a line, articulating externally with the scaphoid bone, and internally with the semilunar bone; 2d, Anteriorly, a surface for the insertion of the anterior ligament of the



articulation of the wrist ; 3d, Posteriorly, two grooves, the external for the tendon of the extensor longus pollicis, the internal for the tendons of the extensor communis and extensor proprius pollicis muscles ; 4th, On the inside, a narrow concave surface, articulating with the inferior extremity of the ulna ; 5th, On the outside, two grooves, the anterior for the abductor longus and extensor brevis pollicis manus ; the posterior for the tendons of the radial muscles ; in fine, externally and inferiorly, the *styloid* process, an eminence to which the external lateral ligament of the articulation of the carpus is attached. *Development.*—The body of the radius begins to appear at the same time as the humerus, but it is not perfect till many years after birth.

#### ULNA.

*Form.*—Long, irregular, more voluminous superiorly than inferiorly, divided into a body and two extremities. *Body.*—Prismatic, triangular ; its *anterior* face gives attachment superiorly to the flexor profundus, inferiorly to the pronator teres muscle ; it also presents the foramen for the nutritious vessels of the bone. Its *posterior* face is divided by a prominent line into two parts, the internal of which gives attachment to the anconeus and ulnaris, and the external to the supinator brevis, abductor longus pollicis, extensor pollicis longus, and extensor proprius pollicis. Its internal face is covered by the flexor profundus. Its external border gives insertion to the interosseous ligament ; the anterior to the flexor profundus and pronator quadratus ; and the posterior border receives the insertion of the common aponeurosis of the ulnaris externus and internus, and flexor profundus muscles.

*Superior, or humeral extremity.*—Formed of two processes ; the one posterior, termed the *olecranon*, gives attachment superiorly to the triceps brachialis, is covered posteriorly by the skin, and is concave in front ; the other anterior, termed the *coronoid* pro-

cess, presents inferiorly an impression for the insertion of the brachialis internus muscle; gives attachment on the inner side to a part of the pronator teres and superficial flexor muscles, and to the internal lateral ligament of the articulation of the ulna with the humerus; and on the outside presents the *small sigmoid cavity of the ulna*, articulating with the head of the radius, and surmounted by the *large sigmoid cavity*, which is divided by a vertical prominence, and articulates with the pulley of the humerus.

*Inferior, or carpal extremity.*—This is very small, formed of two eminences; 1st, On the outside by the head of the ulna, contiguous to the triangular fibro-cartilage of the articulation by its inferior part, articulated by the external with the radius; 2d, On the inside by a small process, which gives attachment at its summit to the internal lateral ligament of the articulation of the wrist. These two eminences are separated posteriorly by a groove for the tendon of the ulnaris externus, inferiorly by a depression for the insertion of the fibro-cartilage of the articulation.

#### OF THE HAND.

This is the last portion of the superior extremity; it is divided into the carpus, metacarpus, and fingers.

#### CARPUS.

This is situated between the metacarpus and forearm; it is formed of eight bones, disposed in two ranges, viz., for the first range, and from without inward, the *os scaphoides*, *lunare*, *cuneiforme*, and *pisi-forme*; for the second, and in the same direction, the *trapezium*, *trapezoides*, *magnum*, and *unciforme*.

#### OS SCAPHOIDES.

*Figure.*—Short, convex on one side, concave on the other, divided into six faces; 1st, *Superior face*, articulating with the radius; 2d, *Inferior face*, united with

the trapezium and trapezoides; 3d, *Posterior face*, presenting a groove for the insertion of the ligaments; 4th, *Anterior face*, uneven, giving insertion to ligaments; 5th, *External face*, receiving the attachment of the external lateral ligament of the articulation of the carpus; 6th, *Internal face*, articulating by two surfaces, superiorly with the semilunar bone, inferiorly with the os magnum.

*Development.*—The scaphoid bone does not begin to ossify till several years after birth.

#### OS LUNARE.

*Form.*—Short, irregularly triangular, divided into six faces; 1st, *Superior face*, articulating with the radius; 2d, *Inferior face*, united to the os magnum and os unciforme; 3d and 4th, *Anterior and posterior faces*, each giving insertion to some ligaments; 5th, *External face*, articulating with the scaphoid bone; 6th, *Internal face*, articulating with the os cuneiforme.

*Development.*—Ossification commences as late as in the scaphoid bone.

#### OS CUNEIFORME.

*Form.*—That of a cone, divided into six faces; 1st, *Superior face*, contiguous to the triangular fibro-cartilage of the articulation of the carpus; 2d, *Inferior face*, resting on the os unciforme; 3d, *Posterior face*, giving attachment to ligaments; 4th, *Anterior face*, receiving the insertion of ligaments, uniting on the inner side to the os pisiforme by a facet; 5th, *External face*, articulating with the os lunare; 6th, *Internal face*, serving for the insertion of ligaments.

#### OS PISIFORME.

*Form.*—Somewhat rounded, very small, articulating posteriorly with the os cuneiforme; giving attachment superiorly to the ulnaris internus muscle, inferiorly to the adductor minimi digiti, anteriorly to the annular ligament of the carpus. *Development.*—These last two bones ossify like the scaphoid bone.

## OS TRAPEZIUM.

*Form.*—Very irregular and uneven, divided into six faces; 1st, *Superior face*, articulating with the scaphoid bone; 2d, *Inferior face*, uniting to the first metacarpal bone; 3d and 4th, *Posterior and external faces*, giving insertion to ligaments; 5th, *Anterior face*, marked by a groove, through which the tendon of the *radialis internus* passes, and giving insertion by an eminence to the anterior annular ligament of the carpus, and to the *abductor and opponens pollicis*; 6th, *Internal face*, articulating with the trapezium and second metacarpal bone by two facets.

*Development.*—This bone is entirely cartilaginous till the age of six years.

## OS TRAPEZOIDES.

*Form.*—Smaller than the preceding, irregular, divided into six faces; 1st, *Superior face*, articulating with the scaphoid bone; 2d, *Inferior face*, uniting to the second metacarpal bone; 3d and 4th, *Posterior and anterior faces*, giving insertion to ligaments; 5th, *External face*, articulating with the trapezium; 6th, *Internal face*, articulating with the *os magnum*.

*Development.*—Ossification commences here later than in the preceding.

## OS MAGNUM.

*Form.*—More considerable than the others, cubical inferiorly, rounded superiorly, divided into six faces; 1st, *Superior face*, articulating with the scaphoid and lunar bones; 2d, *Inferior face*, articulating by three surfaces with the second, third, and fourth metacarpal bones; 3d and 4th, *Posterior and anterior faces*, receiving the insertion of ligaments; 5th, *External face*, united to the trapezoides; 6th, *Internal face*, articulating with the *os unciforme*.

*Development.*—In the full-grown fœtus this bone is ossified in its centre, but not very perceptibly.

## OS UNCIFORME.

*Form.*—Cuneiform, unciform in front, divided into six faces; 1st, *Superior face*, articulating with the lunar bone; 2d, *Inferior face*, articulating with the fourth and fifth metacarpal bones by two facets; 3d, *Posterior face*, giving insertion to ligaments; 4th, *Anterior face*, presenting a slightly curved process, where the anterior annular ligament of the carpus, and some of the muscles of the hypothenar eminence are fixed; 5th, *External face*, uniting to the os magnum; 6th, *Internal face*, articulating with the os cuneiforme.

*Development.*—We discover in this bone also, in the full-grown fœtus, an osseous nucleus, larger than that in the os magnum.

## OF THE METACARPUS.

This is formed of five bones, named in numerical order, counting from without inward.

## FIRST METACARPAL BONE.

*Form.*—Long and irregular, shorter and thicker than the other bones of the same region, flattened from before backward, divided into a body and two extremities; 1st, *Body*, covered posteriorly by the tendons of the extensor muscles of the thumb, giving attachment in front, by a crest, to the opponens and flexor brevis pollicis muscle, on the inner and upper side to the first dorsal interosseous muscle; 2d, *Superior, or carpal extremity*, presenting a surface articulating with the trapezium, giving attachment, on the outer side, to the abductor longus pollicis; 3d, *Inferior extremity*, convex, articulating with the first phalanx of the thumb.

## SECOND METACARPAL BONE.

*Form.*—Longer and larger than the others, prismatic, divided into a body and two extremities.

*Body*.—Presenting posteriorly a prominent line, and beneath this a triangular surface, to the exterior of which the first dorsal interosseous muscle is fixed, and to the interior, the second; anteriorly, a rounded border, covered by the tendon of the flexors, giving attachment on the outer side to the first dorsal interosseous muscle, and on the inner to the first palmar interosseous muscle. *Superior extremity*.—Articulating, by a concave surface, with the trapezoid bone; on the outer side, by a small surface, with the trapezium; on the inner, by two facets, with the os magnum and third metacarpal bone; giving attachment posteriorly, by a prominence, to the radialis longior, anteriorly to the radialis internus muscle. *Inferior extremity*.—Articulating with the first phalanx of the index finger.

#### THIRD METACARPAL BONE.

*Body*.—Giving attachment anteriorly to the flexor brevis pollicis and adductor pollicis, on the outer side to the second dorsal interosseous muscle, and on the inner side to the third. *Superior extremity*.—Articulating superiorly, by a nearly flat surface, with the os magnum, on the outer side with the second metacarpal bone, on the inner with the third; giving attachment posteriorly to ligaments, and to the radialis brevior; anteriorly to ligaments. *Inferior extremity, or head*.—Articulating with the first phalanx of the middle finger.

#### FOURTH METACARPAL BONE.

1. *Body*.—Giving attachment, on the outer side, to the second palmar and third dorsal interosseous muscles, and on the inner side to the fourth dorsal interosseous muscle. 2. *Superior extremity*.—Articulating superiorly with the os unciforme and os magnum, on the outer side with the third metacarpal bone, on the inner with the fifth; giving attachment, anteriorly and posteriorly, to ligaments. 3. *Inferior extremity*.—Articulating with the first phalanx of the ring finger.

## FIFTH METACARPAL BONE.

1. *Body*.—Divided posteriorly by a line into two parts, the external of which gives attachment to the fourth dorsal interosseous muscle, and the internal is in relation with the tendons of the extensor muscles of the little finger. It receives the insertion, on the outer side and in front, of the third palmar interosseous muscle, on the inner side that of the *opponens minimi digiti*. 2. *Superior extremity*.—Articulating superiorly with the *os unciforme*, on the outer side with the fourth metacarpal bone, giving attachment, on the inner side, by a tuberosity, to the *ulnaris externus*, anteriorly and posteriorly to ligaments. 3. *Inferior extremity*.—Uniting with the first phalanx of the little finger.

*Development*.—Ossification in the metacarpal bones begins at the third month of pregnancy. It is first seen in the second, next in the third, and then in the others.

## OF THE FINGERS.

Five fingers on each hand ; formed each of three bones termed phalanges, except the thumb, which has but two. *Form*.—The phalanges are long, flattened from before backward ; the superior larger than the middle, and these latter larger than the inferior. Their anterior face is concave, covered by the tendons of the flexors ; the *posterior* face is convex, and covered by the tendons of the extensors.

## FIRST PHALANGES.

One to each finger. 1st, *Anterior face*.—In form of a groove for the tendons of the flexor muscles, giving attachment by its edges to their fibrous sheaths. 2d, *Upper extremity*.—Quadrilateral ; articulating superiorly, by an oval cavity, with the head of the metacarpal bones, giving attachment by its sides to the lateral ligaments ; that of the first phalanx of the thumb receiving the insertion of the ab-

ductor pollicis brevis, of the flexor pollicis brevis, and the abductor pollicis longus. 3d, *Lower extremity*.—It presents two small condyles, separated by a groove, and articulated with the second phalanges.

Of these five bones, that of the middle finger is the largest; those of the second and fourth fingers are nearly equal in length, and so too of the first and fifth. That of the thumb is proportionally the broadest and flattest.

#### SECOND PHALANGES.

This bone is deficient in the thumb. 1st, The *anterior face* presents impressions to which the extremities of the tendons of the flexor digitorum sublimis are inserted. 2d, The *upper extremity* is grooved by two facets, which are united with the condyles of the first phalanges, and give attachment posteriorly to a portion of the extensor digitorum communis muscle. 3d, The *lower extremity* is articulated with the third phalanges.

In this range of bones, that of the middle finger is the longest and strongest; next come those of the fourth and second fingers. That of the little finger is the shortest.

#### THIRD PHALANGES.

*Figure*.—Very short, pyramidal, flattened from before backward. 1st, The *posterior face* is covered by the nails. 2d, The *anterior face* gives attachment to the tendons of the flexor profundus. 3d, The *base* is concave, articulated with the condyles of the lower extremities of the second phalanges, and gives attachment posteriorly to the tendons of the extensor digitorum communis muscle. 4th, The summit is covered by the pulp of the fingers.

The phalangeal bone of the thumb in this range is much larger and thicker than the rest, which are smaller, and nearly equal in length, but which vary in thickness.



## II. INFERIOR, OR ABDOMINAL EXTREMITIES.

They are articulated with the inferior lateral parts of the trunk, and divided into three parts, viz., thigh, leg, and foot.

## OF THE THIGH.

This is formed of one bone, the *femur*.

## FEMUR.

*Situation*.—Between the lateral and inferior parts of the pelvis and leg. *Form*.—It is the longest and largest of all the bones; it is cylindrical, a little curved anteriorly, directed downward and inward, divided into a body and two extremities. *Body*.—This is thicker superiorly and inferiorly than in the middle, is slightly prismatic in its three superior fourths, and flattened from before backward in its inferior quarter. 1st, *Anterior face*.—Convex, covered by the triceps cruris muscle, which is fixed to its three superior quarters; 2d, *External face*, giving attachment to the external part of the same muscle, termed the vastus externus; 3d, *Internal face*, covered by the internal part of the same, or the vastus internus; 4th, *Lateral borders*, giving attachment to the same muscle; 5th, *Posterior border*, presents the linea aspera, bifurcated at its extremities, giving attachment on the outer side to the triceps and short portion of the biceps muscle, on the inner side to the former of these two muscles, and in the middle to the three adductor muscles. The external branch of the superior bifurcation of the linea aspera is directed towards the great trochanter, and receives, on the outer side, the insertion of the triceps cruris, on the inner side that of the second adductor, and in the middle that of the tendon of the glutæus maximus; the internal branch, directed towards the little trochanter, gives attachment to the triceps and pectineus muscles; the interval of this bifurcation is covered by the quadratus femoris and third adductor; the branches of the inferior bifurca-

tion are directed towards the condyles, and give attachment, the external to the triceps and biceps muscles, the internal, marked by the femoral artery, to the triceps and third adductor; the interval is triangular, corresponds to the popliteal vessels and nerves, and presents inferiorly inequalities for the attachment of the gemelli muscles. *Superior, or pelvic extremity.*—Formed of three eminences; 1st, On the internal and superior side, the head of the femur, a spherical eminence, directed upward and inward, presenting, in the middle, a cavity for the attachment of the internal ligament of the articulation; it articulates with the acetabulum of the innominatum; is supported by a neck, and is united at an obtuse angle to the body of the bone; it is flattened from before backward; is separated inferiorly from the body of the bone by two oblique lines, one anterior, the other posterior, proceeding from the great trochanter, and giving attachment to the capsular ligament; 2d, On the outer side, the great trochanter, a large, prominent, quadrilateral eminence; its external surface is covered by the tendon of the glutæus maximus, a synovial capsule intervening between it and the bone; it terminates inferiorly by a crest for the attachment of a portion of the triceps muscle; its internal surface is marked by the digital cavity, where the pyramidalis, gemelli, and internal and external obturator muscles are fixed; its anterior border gives attachment to the glutæus minimus muscle; its posterior border to the quadratus femoris, and its summit to the glutæus medius; 3d, The small trochanter, a pyramidal eminence, situated posteriorly and on the inner side beneath the neck, giving attachment by its summit to the united tendons of the psoas parvus and iliacus muscles. *Inferior extremity.*—This is very large, and is formed of two eminences, termed condyles; these are distinguished into internal and external, and are united anteriorly, where they present an articulating surface for the patella; they articulate inferiorly with the tibia, being separated posteriorly by a space occupied by the crucial ligaments. The internal condyle con-

sents, on the inner side, the internal tuberosity, for the insertion of the internal lateral ligament of the knee, and of the great adductor muscle. The external condyle presents, on the outer side, the external tuberosity for the attachment of the external lateral ligament, and beneath this eminence a depression for the tendon of the popliteus muscle; it gives attachment, on its inner side, to the anterior crucial ligament. *Development.*—The femur appears first towards the second month of pregnancy, at which time its length, breadth, and thickness are nearly the same.

## OF THE LEG.

This is formed of three bones; the tibia on the inner side, the fibula on the outer, and the patella anteriorly and superiorly.

## PATELLA.

*Situation.*—At the anterior part of the knee. *Form.*—Triangular, with the angles rounded, divided into two surfaces, one base, two lateral borders, and one summit. *Anterior face.*—Covered by aponeurotic expansions and by the skin. *Posterior face.*—Divided by a longitudinal prominence into two surfaces, articulating with the condyles of the femur, presenting inferiorly a rough surface, for the attachment of the ligamentum patellæ. *Base.*—Giving attachment to the tendons of the rectus femoris and triceps muscles. *Lateral borders.*—Covered by the aponeurosis. *Summit.*—Receiving the insertion of the ligamentum patellæ. *Development.*—Ossification of the patellæ does not commence till after birth.

## TIBIA.

*Form.*—Long, prismatic, and triangular, slightly curved, divided into a body and two extremities. *Body.*—1st, Internal surface, covered superiorly by the aponeurotic expansions of the sartorius, gracilis, and semi-tendinosus muscles; sub-cutaneous in the rest of its extent. 2d, External surface, giving at-

tachment superiorly to the tibialis anticus; covered inferiorly by the tendons of this muscle, of the common extensor of the toes, of the extensor of the great toe, and of the peroneus longus. 2d, Posterior surface, traversed superiorly by a prominent line, oblique inferiorly and on the inner side, to which are attached the popliteus, soleus, tibialis posticus, and flexor communis digitorum pedis; the triangular space which is inferiorly is covered by the popliteus muscle; the space above gives attachment to the flexor longus and tibialis posticus. 4th, Anterior border, or crest, gives attachment to the aponeurosis of the leg, as also to the united tendons of the sartorius, gracilis, and semi-tendinosus. 5th, Internal border, receiving superiorly the insertion of the internal lateral ligament, and beneath this, of the popliteus, soleus, and flexor longus digitorum pedis. 6th, External border, giving insertion to the inter-osseous ligament. *Superior extremity.*—Presenting superiorly two concave surfaces, rounded, termed the *condyles of the tibia*; articulating with the condyles of the femur; separated by the *spine of the tibia*, an eminence provided with two tubercles, and before and behind which are two depressions for the insertion of the semilunar cartilages and crucial ligaments. This extremity presents anteriorly a triangular surface, terminating inferiorly by a tubercle for the attachment of the ligamentum patellæ, posteriorly a deep notch, and laterally the tuberosities of the tibia, distinguished into internal and external; the former gives attachment to the internal lateral ligament, the latter presents an articulating surface for the fibula. *Inferior extremity.*—Quadrilateral, giving attachment anteriorly and posteriorly to ligaments, presenting in this latter region a groove for the tendon of the flexor longus pollicis pedis; presenting on the outer side a rough cavity for the insertion of ligaments, and articulating inferiorly with the fibula; presenting on the inner side the internal malleolus, a triangular eminence, flattened transversely, sub-cutaneous on the inner side, articulating on the outer with

the astragalus; terminating anteriorly by a border, into which the ligaments are inserted, posteriorly by another border, marked by a groove for the tendon of the tibialis posticus and flexor communis digitorum pedis; giving attachment, by its summit, to the internal lateral ligament of the articulation of the tarsus. This extremity is marked inferiorly by a quadrilateral cavity, divided into two parts by a line, and articulating with the astragalus. *Development*.—The tibia develops itself towards the end of the second month of pregnancy, by three points of ossification.

#### THE FIBULA.

*Form*.—Long, and very thin, divided into a body and two extremities. *Body*.—Prismatic, triangular, and slightly twisted; 1st, *Internal face*.—Divided by a crest, for the insertion of the interosseous ligament, into two parts; an anterior, which gives attachment to the extensor communis digitorum pedis, extensor longus pollicis pedis, and peroneus tertius; the other posterior, which receives the attachment of the tibialis posticus; 2d, *External face*, which gives attachment superiorly to the peroneus brevis; 3d, *Posterior face*, which gives attachment superiorly to the soleus muscle, inferiorly to the flexor longus pollicis pedis, and at the most inferior part it presents a triangular surface, articulating with the tibia; 4th, *Anterior border*.—This gives attachment, on the inner side, to the extensor communis digitorum pedis and peroneus tertius, on the outer side to the peronei muscles; 5th, *Internal border*.—This gives attachment superiorly to the tibialis posticus and flexor longus pollicis pedis, inferiorly to the interosseous ligament; 6th, *External border*.—This gives attachment posteriorly to the soleus and flexor longus pollicis pedis, and anteriorly to the peroneal muscles.

*Superior, or tibial extremity*.—Rounded, presenting on the inside a concave surface for its articulation with the tibia; on the outside a pyramidal, uneven eminence, which gives attachment to the external

lateral ligament of the articulation of the knee, to other ligaments, and to the tendon of the biceps cruris muscle. *Inferior, or tarsal extremity.*—Flattened from within outward, forming the malleolus externus; covered on the outer side by the skin; presenting on the inner side a triangular surface for the articulation with the astragalus, and an uneven depression for the attachment of the posterior ligaments of the tibio-tarsal articulation; terminating anteriorly by a border for the insertion of ligaments; posteriorly by another border, marked by a groove for the passage of the tendons of the peronei muscles; inferiorly by a pyramidal summit, where the external lateral ligament of the articulation is fixed.

*Development.*—The body of the fibula appears a little later than the tibia. In the fœtus of ten weeks it is only half as long as this latter.

#### OF THE FOOT.

This is the third portion of the inferior extremity, and is divided into the tarsus, metatarsus, and toes.

#### THE TARSUS.

This is formed of seven bones, viz., the *calcaneum*, *astragalus*, *naviculare*, *cuboides*, and *three cuneiform bones*.

#### CALCANEUM.

*Situation.*—At the posterior and inferior part of the tarsus. *Form.*—Short, elongated from before backward, flattened transversely, divided into six faces; 1st, *Superior face*, presenting posteriorly a concave surface, placed in front of the tendo achillis; in the middle, a surface turned forward, articulating with the astragalus; in front and on the outer side, an uneven depression for the insertion of ligaments; in front and on the inner side, another facet, which unites with the astragalus, and which is separated from the preceding by an uneven and trans-

verse cavity, to which is attached a ligament, which goes to the *small apophysis of the calcaneum*; 2d, *Inferior face*, presenting posteriorly two tubercles for the attachment of the superficial muscles of the sole of the foot, separated by a depression for a ligament; in front, another tuberosity, into which the inferior ligament of the calcaneum and naviculare is inserted; 3d, *Anterior face*, articulating with the cuboid bone; 4th, *Posterior face*.—Uneven inferiorly for the insertion of the tendo achillis; 5th, *External face*.—Sub-cutaneous, presenting anteriorly two superficial grooves for the tendons of the peronei muscles; 6th, *Internal face*.—Concave, in relation with the tendons of the flexor digitorum communis, the tibialis posticus, and the flexor longus pollicis pedis; presenting superiorly a groove for the tendon of this latter muscle. *Development*.—Of the tarsal bones the calcaneum is developed the first, appearing at the sixth month of pregnancy as a single nucleus in the centre of the cartilage.

#### THE ASTRAGALUS.

*Situation*.—In the middle and superior part of the tarsus.

*Form*.—Very short, irregular, divided into six faces; 1st, *Superior face*.—Presenting in its anterior third an uneven depression for the insertion of ligaments; posteriorly a convex surface in the form of a pulley, articulating with the tibia; 2d, *Inferior face*.—Articulating with the calcaneum by two surfaces, one posterior, large and concave, the other anterior, small and convex, separated from one another by a depression for the insertion of the ligaments which go to the calcaneum; 3d, *Anterior face*.—Convex, articulating with the os naviculare, supported by a narrow neck; 4th, *Posterior face*.—Marked by an oblique groove, through which the tendon of the flexor longus pollicis pedis passes; presenting on the inner side an eminence for the attachment of a ligament; 5th, *Internal face*.—Articulating superiorly with the internal mal-



leolus; giving insertion in the rest of its extent to ligaments; 6th, *External face*.—Articulated with the fibula.

*Development*.—The rudiments of the astragalus appear first in the seventh month of pregnancy. In the full-grown fœtus it is a round nucleus of bone, the body and head being nearly equal in size.

#### OS NAVICULARE.

*Situation*.—At the middle and inner part of the tarsus. *Form*.—Flattened from before backward, oval, divided into two faces and a circumference; 1st, *Anterior face*.—Articulating by three facets with the three cuneiform bones; 2d, *Posterior face*.—Articulating with the astragalus; 3d, *Circumference*.—Rough superiorly, inferiorly, and on the outer side, where the ligaments are attached; sometimes articulated on the outer side with the os cuboides; rough on the inner side for the insertion of the tendon of the tibialis posticus muscle.

*Development*.—Ossification of the scaphoid bone does not commence till after birth, and usually towards the end of the first year.

#### OS CUBOIDES.

*Situation*.—At the external and anterior part of the tarsus.

*Figure*.—Irregularly cuboid; divided into six faces; 1st, *Superior face*.—Uneven, covered by the extensor brevis digitorum pedis; 2d, *Inferior face*.—Presenting in the middle an eminence, which gives attachment to the inferior ligament of the articulation of the calcaneum and cuboid bones; anteriorly a groove for the tendon of the peroneus longus muscle; posteriorly a depression for the insertion of ligaments; 3d, *Anterior face*.—Articulating by two surfaces with the fourth and fifth metatarsal bones; 4th, *Posterior face*.—Articulating with the calcaneum; 5th, *External face*.—Marked by a superficial groove occupied by the tendon of the peroneus longus muscle; 6th, *In-*



*ternal face*.—Articulating in the middle with the first cuneiform bone ; rough anteriorly and posteriorly for the insertion of ligaments.

*Development*.—Ossification of the cuboid bone begins about the eighth month of pregnancy.

#### CUNEIFORM BONES.

Of these there are three, situated at the interior and inner part of the foot, having the form of a wedge ; distinguished by their numerical names, counting from within outward.

*Development*.—The cuneiform bones do not ossify till after birth.

#### FIRST CUNEIFORM BONE.

*Form*.—That of a wedge, the base of which is turned downward ; divided into four faces, a base, and a summit ; 1st, *Anterior face*.—Articulating with the first metatarsal bone ; 2nd, *Posterior face*.—Articulating with the scaphoid bone ; 3d, *Internal face*.—Sub-cutaneous ; 4th, *External face*.—Articulating by two surfaces with the second metatarsal and second cuneiform bones ; 5th, *Base*.—Rough, giving attachment to the tibialis anticus, and to a portion of the tendon of the tibialis posticus ; 6th, *Summit*.—Turned upward, forming a thin border.

#### SECOND CUNEIFORM BONE.

1st, *Anterior face*.—Articulating with the second metatarsal bone ; 2d, *Posterior face*.—Uniting with the os naviculare ; 3d, *Internal face*.—Articulating with the first cuneiform bone, giving attachment inferiorly to ligaments ; 4th, *External face*.—Articulating with the third cuneiform bone ; 5th, *Base*.—Turned upward, giving insertion to ligaments, as does also the *summit*, which is directed downward.

## THIRD CUNEIFORM BONE.

1st, *Anterior face*.—Articulating with the third metatarsal bone; 2d, *Posterior face*.—Uniting with the scaphoid bone; 3d, *Internal face*.—Articulating with the second metatarsal bone and second cuneiform by two facets; 4th, *External face*.—Articulating by two facets, one small, the other large, with the fourth metatarsal bone and os cuboides; giving attachment inferiorly to ligaments; 5th, *Base*.—Rough, sub-cutaneous; 6th, *Summit*.—Turned downward; rough.

## OF THE METATARSUS.

Situated between the tarsus and the toes. Composed of five bones parallel to one another, and named in numerical order, counting from within outward.

*Development*.—The metatarsal bones form gradually by the union of two pieces of bone. The longest appears first in the third month of pregnancy, and is perfectly developed in the full-grown fœtus.

## FIRST METATARSAL BONE.

*Form*.—Elongated, shorter than the rest, divided into a body and extremities. *Body*.—Prismatic; superior face sub-cutaneous, the inferior face covered by the flexor brevis pollicis pedis; its external face corresponds superiorly to the first dorsal interosseous muscle, inferiorly to the abductor pollicis pedis. *Posterior extremity*.—Articulating with the first cuneiform bone; presenting inferiorly a tubercle for the attachment of the peroneus longus. *Anterior extremity*.—Articulating with the first phalanx of the great toe; presenting inferiorly two depressions for the sesamoid bones, and on the side the impressions of the ligaments.

## SECOND METATARSAL BONE

*Form*.—Longer than the rest. *Body*.—Its superior side divided by an edge into two parts, the internal of

which gives attachment to the first dorsal interosseous muscle, and the external to the second; its inferior side is covered by the abductor pollicis pedis and two first plantar interosseous muscles; its internal and external sides are each in relation with an interosseous muscle. *Posterior extremity*.—Articulating posteriorly with the second cuneiform bone, on the inside with the first, on the outside with the third, and with the third metatarsal bone by as many facets. *Anterior extremity*.—Convex, articulating with the first phalanx of the second toe; giving attachment to some ligamentous fibres.

#### THIRD METATARSAL BONE.

*Body*.—Its superior side is divided by a prominent line, giving attachment to the second and third dorsal interosseous muscles; its lateral sides correspond to the same muscles; its inferior side gives attachment to the first plantar interosseous muscle. *Posterior, or tarsal extremity*.—Articulating posteriorly with the third cuneiform bone, on the inner side with the second metatarsal bone, on the outer side with the fourth; giving attachment inferiorly to ligaments. *Anterior extremity*.—Articulating with the first phalanx of the third toe.

#### FOURTH METATARSAL BONE.

*Body*.—Its superior side gives attachment to the third and fourth dorsal interosseous muscles; its external side is narrow, and gives insertion to the fourth dorsal interosseous muscle; its internal side, and also the inferior, to the second plantar interosseous muscle. *Posterior extremity*.—Cubical, articulating posteriorly with the os cuboides, on the inner side with the third metatarsal and third cuneiform bones, on the outer side with the fifth metatarsal, giving insertion superiorly and inferiorly to ligaments. *Anterior extremity*.—Articulating with the first phalanx of the fourth toe.

## FIFTH METATARSAL BONE.

*Body.*—Prismatic, larger posteriorly than anteriorly. Its superior side inclines outward; its inferior gives attachment to the third plantar interosseous muscle, which covers it, as also the flexor brevis digiti minimi pedis; its internal side gives insertion superiorly to the fourth dorsal interosseous muscle; inferiorly to the third plantar muscle. *Posterior extremity.*—Pyramidal, articulating posteriorly with the os cuboides, on the inner side with the fourth metatarsal bone; presenting on the outer side a prominent tuberosity, into which the peroneus brevis muscle and a portion of the abductor minimi digiti pedis are inserted. *Anterior extremity.*—Articulating with the first phalanx of the fifth toe.

## OF THE TOES.

These are five in number, formed each of three portions, termed phalanges, except the great toe, which has but two. Their superior surfaces are covered by the tendons of the extensor muscles, their inferior correspond to the tendons of the flexors; their borders give attachment to the fibrous sheaths of these tendons, and their posterior extremities articulate with the metatarsal bones.

## FIRST PHALANGES OF THE TOES.

*Form.*—Elongated, thin, and rounded. 1. *Body.*—Thin anteriorly, thicker posteriorly. Its *superior* face is covered by the tendons of the extensor muscles; its *inferior* face corresponds to the tendons of the flexor muscles; the lateral parts of this face give attachment to the fibrous sheaths of the preceding tendons; its *lateral* edges correspond to the tendons of the interossei and lumbricales muscles. 2. *Posterior extremity.*—Concave, articulated with the bones of the metatarsus, giving attachment to ligaments. 3. *Anterior extremity.*—Formed by two condyles, separated

by a groove, and articulated with the two phalanges. *Development*.—These bones do not begin to appear until the fourth month of pregnancy, except in the large toe.

#### SECOND PHALANGES OF THE TOES.

In the first toe this bone is deficient. *Form*.—Very short, nearly cubical, and square. 1. *Upper face*.—Covered by the tendons of the extensors of the toes. 2. *Lower face*.—Giving attachment to the tendons of the flexor digitorum pedis brevis. 3. *Lateral edges*.—Giving attachment to the fibrous sheaths of the tendons. 4. *Posterior extremity*.—Articulated with the condyles of the first phalanges by a concave facet. 5. *Anterior extremity*.—Articulated by two condyles with the third phalanges. *Development*.—Ossification does not commence till after the fifth month of pregnancy.

#### THIRD PHALANGES OF THE TOES.

*Form*.—Very small, pyramidal. 1. *Body*.—Its upper face supports the nail, and gives attachment to the tendon of the extensor digitorum pedis longus. Its lower face gives insertion to the tendon of the flexor digitorum pedis longus. 2. *Lower extremity, or base*.—Articulated with the second phalanges. 3. *Anterior extremity, or summit*.—Tubercular, and supporting the pulp of the toes. *Development*.—This phalanx ossifies before the second. The anterior phalanx of the first toe appears sooner than the posterior, and even than all the other phalanges.

#### SESAMOID BONES.

Small, irregular bones, rounded, varying in existence and number, placed in some of the articulations of the fingers and toes. In the hand, we generally find two in the metacarpo-phalangean articulation of the thumb, one or two in that of the index finger, one in the phalangean articulation of the thumb, &c.

## ARTICLE III.

*Of the Articulations.*

By *articulations* we understand the parts by which the bones are united. The means by which the bones are connected are, 1st, The extremities of the bones; 2d, The cartilages; 3d, The fibro-cartilages; 4th, The synovial membranes; and 5th, The ligaments. We shall first describe these parts generally, and then each of the joints in detail.

## SECTION I.

## OF THE PARTS CONSTITUTING THE ARTICULATIONS.

## I. EXTREMITIES OF THE BONES.

The articular extremities of the bones present eminences and depressions, which correspond, and which render the joint moveable and immoveable, according to the manner in which they are united.

The immoveable articulations, or *synarthroses*, belong particularly to the bones which form cavities. Of these articulations there are four species. 1st, The *suture*, which is divided into the *dentated*, seen on the arch of the scull, and the *squamous*, of which the temporal suture is an instance. 2d, The *harmonia*, which takes place by the juxtaposition of two bones, as in the face. 3d, *Gomphosis*, or insertion of bones in a cavity (as the teeth). 4th, *Schindylesis*, where a plate is received in a fissure. This is seen in the union of the vomer and the sphenoid bone. The moveable articulations, or *diarthroses*, are subdivided into those by *continuity* and those by *contiguity*. The moveable articulations by continuity are termed *amphiarthroses*, and consist in the intimate union of the articular surfaces by an intermediate fibro-cartilaginous body, which is supple and elastic, and which admits of motion. An instance of this is seen in the union of the bodies of the vertebræ.

Diarthroses by contiguity are of two kinds. The

first kind admits of motion in every direction, and is termed *orbicular diarthrosis*. It is subdivided into *enarthrosis*, when the articulation takes place by a head received into a cavity (coxo-femoral articulation), and into *arthrodia* when the articular surfaces are plane, or nearly plane (temporo-maxillary articulation). The second kind of diarthrosis by contiguity admits only confined and opposite motions, and is termed *ginglymus*. Of this joint there are also two kinds; the *angular ginglymus*, in which the motions are confined to flexion and extension (as in the articulation of the elbow and knee), and the *lateral ginglymus*, which admits only of a rotatory motion, as in the atloido-odontoid and radio-cubital articulations.

## 2. OF THE CARTILAGINOUS SYSTEM.

The cartilages are hard parts, of a grayish white colour, having apparently neither texture nor organization; shining and elastic, and continuous with the extremities of the bones. The cartilages are divided into those which have no perichondrium (these are the articular cartilages), and into those which are covered by this fibrous envelope, as the cartilages of the ribs, of the larynx, &c.

*Articular cartilages*.—These cartilages cover the articulating ends of the bones; they are divided into those of the moveable and those of the immoveable joints. The first, or the diarthrodial, have the form of flat layers, thinner at the circumference than in the centre on the convex articular extremities; and thicker at their edge than in the centre on the concave extremities. One of their faces adheres intimately to these extremities; the other is smooth, and covered by the synovial membrane. In the immoveable articulations, the cartilages are lamellar, and adhere to the bone by their two faces, and to the periosteum by their edges.

*Perichondroid cartilages*.—These cartilages, not being articular, are mentioned in this place only to avoid

separating them from the system of which they make a part. They constitute a portion or the whole of the frame of certain parts, are covered with a fibrous membrane or perichondrium, and cannot be reduced to gelatin by boiling. To these cartilages belong those of the ribs, larynx, nasal septum, trachea, bronchiæ, &c. The forms of these cartilages are very various.

*Structure of the cartilaginous system.*—The articular cartilages are composed of fibres, which are perpendicular to the osseous surface, which they cover. The cartilages which are non-articular are differently organized. The costal cartilages are composed of superimposed elliptical laminæ, united by transverse fibres. These laminæ are composed of fibres, which may be reduced to cellular tissue. The other cartilages of this group are reduced by maceration and boiling, first, into very thin and short fibres, and then into cellular tissue.

*Functions.*—The articular cartilages facilitate motion, lessening by their elasticity the compression and the shocks experienced by the articulations. The perichondroid cartilages constitute partially or entirely certain organs, the form of which they determine.

### 3. OF THE FIBRO-CARTILAGINOUS SYSTEM.

The fibro-cartilages participate, by their tenacity, elasticity, and structure, in the characters of the fibrous tissue, and by their density and whiteness in that of the cartilages: their forms are very various. They are divided, 1st, Into those which have their two faces loose: they are interarticular, and are found in the articulations of the jaw, knee, and clavicle; 2d, Those which have one face loose, and the other attached, viz.: those of the tendinous sheaths, and of the circumference of the articular cavities; 3d, Those which are attached by their two faces to bones which they serve to unite: to these belong those of the bodies of the vertebræ, of the symphysis pubis, &c.



*Structure.*—This system results from different combinations of the fibrous and cartilaginous tissues. The fibrous substance predominates in the intervertebral fibro-cartilages, where it forms concentric layers; it is less abundant in the interarticular fibro-cartilages, and still less so in the sheaths of the tendons, &c. *Functions.*—Some of the fibro-cartilages serve to facilitate the motions of certain tendons; others to favour the mobility of the articular surfaces, between which they are placed either as a kind of cushion or as elastic ligaments.

#### 4. SYNOVIAL SYSTEM.

The synovial membranes are whitish, semitransparent, thin, and soft serous organs, existing in great numbers in the locomotive apparatus, and placed between the surfaces which move on each other. They are divided into the subcutaneous synovial bursæ, the synovial membranes of the tendons, and those of the articulations. The subcutaneous bursæ are small rounded vesicles, interposed between the skin and certain prominent osseous or cartilaginous parts. They exist on the trochanter, the patella, the olecranon, &c. The *synovial* membranes of the tendons are of two kinds: some are vesicular, and interposed between the tendinous parts and the bones or cartilages, or between the tendons alone; their external surface adheres to these parts. The others are termed vaginal, because they form complete sheaths around the tendons. These sheaths are composed of two superimposed cylindrical folds, continuous by their two extremities, contiguous by one of their faces, adherent by the other.

The *synovial membranes* of the articulations all have the form of a closed sack. They line the surfaces of the diarthrodial joints, their ligaments, and all the parts directly surrounding them. They form fimbriated duplicatures floating in their cavity, and are termed fimbriated prolongations. The external face of the articular synovial membranes is intimately

united with the adjacent parts. The internal is loose and contiguous to itself. The tissue of the synovial membranes differs from the cellular tissue only in being a little more dense.

*Functions.*—The functions of the synovial membranes are to facilitate the motions of the parts between which they are situated. They fulfil the uses for which nature has designed them, partly by the smoothness of their surface, and partly by the presence of a transparent and viscous fluid, termed *synovia*.

#### 5. OF THE LIGAMENTS GENERALLY.

The *ligaments* are fibrous, hard, and very resisting organs, of silvery whiteness, varied in their form, attached, at least by their extremities, to bones or cartilages, and thus serving to unite the articulations and some bony parts. *Divisions.*—They are divided, 1st, Into *articular*, which serve to unite an articulation by attaching itself to the two bones which compose it. 2d, Into *non-articular*, which extend between two parts of a bone, either to change the grooves into a foramen, or to obliterate an opening. 3d, Into *mixed*, which serve for the insertion of the muscles, filling the space left between the two bones. *Form.*—The ligaments have the form of fasciculi or of membranes; the fascicular ligaments have generally the form of a long square. Their breadth exceeds their thickness. The membranous ligaments have a varied form. Those of the articulations are termed *capsular ligaments*. These are the kinds of fibrous sheaths which surround the articulations, and are attached by their extremities to the circumference of the articular extremities of the two bones which compose it.

## SECTION II.

*Syndesmology; or, a Description of the different Joints.*

[*Preparation.*—We begin by detaching with the utmost care all the parts which surround the articulations, excepting the ligaments. We rasp the bones and periosteum, in order to isolate the ligaments completely, and to render them more distinct and apparent. These preparations should not be macerated in water, as this whitens the parts around the ligaments, and thus renders them less distinct.]

The articulations are divided into those of the head, of the trunk, and of the limbs.

## THE ARTICULATIONS OF THE HEAD.

## 1. THE ARTICULATIONS OF THE CRANIUM.

These articulations are immoveable, and differ at the base and at the roof. In the former part the surfaces are generally in juxtaposition, and are separated by a cartilaginous substance; in the latter they are united by a denticulated suture.

## 2. ARTICULATIONS OF THE FACE.

*Articulations of the superior maxilla.*—The bones of the superior maxilla are united by a suture at their circumference; a thin cartilage unites the articular surfaces. *Temporo-maxillary articulation.*—It takes place between the glenoid cavity, the root of the transverse process of the temporal bone, and the condyle of the inferior maxilla; the surfaces are incrustated with cartilage. It presents, 1st, The *external lateral* ligament, inserted superiorly into the tubercle observed at the bifurcation of the zygomatic process, fixed inferiorly to the external side of the neck of the inferior maxilla; 2d, The *internal lateral* ligament, thin, narrower than the preceding, arising superiorly from the spinous process of the sphenoid bone, attached inferiorly to the orifice of the inferior dental

canal; 3d, The *stylo-maxillary* ligament, a thin aponeurotic cord, fixed on one side to the styloid process, on the other to the summit of the angle of the inferior maxilla, and giving attachment to the *styloglossus* muscle; 4th, Two *synovial membranes*, one superior, folded on one side on the glenoid cavity and transverse process, on the other on the superior surface of the fibro-cartilage; the other inferior, covering the inferior face of the latter cartilage and condyle of the inferior maxilla; 5th, An oval fibro-cartilage, convex on one side, concave on the other; in contact superiorly with the glenoid cavity and transverse process, applied inferiorly on the condyle, intimately united to the synovial membranes, free in the greater part of its circumference.

## OF THE ARTICULATIONS OF THE TRUNK.

### 1. ARTICULATIONS OF THE VERTEBRAL COLUMN.

*Articulation of the occiput with the atlas.*—This takes place between the condyles of the occipital bone and superior articulating cavities of the atlas: the surfaces are incrustated with cartilage, and kept in place, 1st, By an anterior ligament composed of two fasciculi, one superficial, rounded, fixed to the basilar process and to the tubercle of the anterior arch of the atlas; the other, thin and broad, is attached in the interval of the condyles in front of the occipital foramen, and to the superior border of the arch of the atlas, between the articular processes; 2d, By a posterior ligament, also formed of two fasciculi, inserted superiorly into the posterior part of the contour of the occipital hole between the condyles, and descending, separates into the posterior, fixed to the arch of the atlas, and anterior, interlacing with the dura mater of the vertebral canal; 3d, By a synovial membrane, which embraces the condyle of the occipital bone and articulating surface of the atlas, and covers anteriorly the anterior ligament, and, on the inner side, the extremity of the transverse ligament.

*Articulation of the occiput with the axis.*—Without contiguous surfaces, susceptible of gliding on one another, composed of three ligaments; 1st, The two odontoid ligaments, thick, rounded, and fixed inferiorly to the summit and sides of the odontoid process, and superiorly to the internal side of each condyle of the occipital bone; 2d, The occipito-axoidean ligament, not admitted by many anatomists, a broad, flat fasciculus, inserted superiorly into the basilar groove, and descending into the vertebral canal behind the odontoid process, is inserted by its deep fibres into the superior part of the transverse ligament, by the middle ones to the posterior part of the body of the axis, and by the anterior into the posterior vertebral ligament.

*Articulation of the atlas and axis.*—The first two vertebræ are united in two ways; the odontoid process corresponds by two surfaces, in front to a surface of the anterior arch of the atlas, posteriorly to the transverse ligament. This articulation presents, 1st, The *transverse ligament*, a thick, fibrous fasciculus, describing a quarter of a circle, attached on each side to the internal part of the articular surfaces of the atlas, at its inferior part giving off a small fasciculus of fibres, which are attached to the body of the axis, corresponding anteriorly to the odontoid process and its ligaments, posteriorly to the occipito-axoidean ligament. 2d, The *anterior synovial membrane*, folded on the contiguous facets of the anterior arch of the atlas and of the odontoid process. 3d, The *posterior synovial membrane*, embracing the posterior surface of the odontoid process and the anterior part of the transverse ligament. Besides, the atlas and axis are united by two articular surfaces, which are incrustated with cartilage. These surfaces are, 1st, Retained in their relations by an anterior ligament, fixed superiorly to the inferior border of the small arch of the atlas and to its anterior tubercle, and inferiorly to the base of the odontoid process, and in front of the body of the axis; by a posterior ligament, very loose, attached to the great arch of the atlas and to the plates of the

axis ; 2d, They are covered by a synovial membrane, equally loose, covering anteriorly a fibrous fasciculus, interiorly the ligaments of the interior of the canal, and exteriorly the vertebral artery.

*Common articulations of the vertebræ.*—All the vertebræ, except the first two, articulate together, 1st, By their body ; 2d, By their articular processes ; 3d, By their plates ; and 4th, By their spinous processes.

*Articulation of the bodies of the vertebræ.*—It presents two ligaments and nine interarticular fibro-cartilages. 1st, *The anterior vertebral ligament* ; this is situated at the anterior part of the bodies of the vertebræ, extending from the axis to the superior part of the sacrum ; it is narrow in the neck, broader in the back and loins. Its superficial fibres are fixed superiorly to the body or fibro-cartilage of one vertebra, and inferiorly to the body or fibro-cartilage of the fourth or fifth vertebra beneath. The middle extends from one vertebra or fibro-cartilage to that of the third vertebra or fibro-cartilage beneath ; and lastly, the deeper ones extend from one vertebra to another. This ligament presents laterally, and in the cervical region, but two small fibrous fasciculi for each vertebra, directed obliquely from within outward, from the superior to that beneath it. 2d, *The posterior vertebral ligament*, situated behind the bodies of the vertebræ, extending from the posterior part of that of the axis and occipito-axoidean ligament to the sacrum ; it is smooth and resplendent, narrower and thicker in the dorsal than in the cervical or lumbar region, broader on a level with each fibro-cartilage than at the bodies of the vertebræ ; composed, like the anterior ligament, of superficial fibres, occupying the interval of four or five vertebræ or their fibro-cartilages, and of deep fibres extending over two vertebræ, or one only, and its fibro-cartilage. 3d, *Intervertebral fibro-cartilages.*—Placed between the bodies of the vertebræ, rounded at their circumference, differing in each region in thickness and volume, intimately adherent by their superior and inferior surfaces to the corresponding surfaces of the bodies of the vertebræ, cor-

responding by the anterior part of their circumference to the anterior vertebral ligament, and by the posterior to the posterior vertebral ligament; formed by dense concentric fibrous plates, nearly vertical, more numerous anteriorly and laterally than posteriorly, frequently crossing, and thus leaving near their centre spaces occupied by a soft, grayish, elastic, pulpy tissue, existing alone in the centre of the fibro-cartilage.

*Articulation of the articulating processes.*—These processes are incrustated with a thin layer of cartilage, covered by a small synovial pouch, which frequently receives the insertion of some irregular ligamentous fibres.

*Articulation of the plates.*—The plates of the vertebræ are not in contact. They are united from the second vertebra to the sacrum by the *ligamenta subflava*, which are divided into two portions, reunited angularly towards the base of the spinous process, elongated transversely, each inserted superiorly into the internal surface of the superior plate, and inferiorly into the superior border of the inferior plate; formed of dense, elastic, and resistant yellow fibres, and serving to complete posteriorly the vertebral canal.

*Articulation of the spinous processes.*—This is effected by means of the inter-spinous and supra-spinous ligaments.

1. *Inter-spinous ligaments.*—These ligaments occupy the intervals of the spinous processes in the dorsal and lumbar regions; they are wanting in the cervical region, are narrow and elongated in the dorsal region, and broader and quadrilateral in the lumbar; each is fixed superiorly to the inferior border of the superior spinous process, and inferiorly to the superior border of the inferior spinous process.

2. *The supra-spinous cervical ligament.*—A cord of very long compact fibres, attached below to the spinous process of the seventh cervical vertebra, and above to the external occipital protuberance.

3. *The supra-spinous ligaments.*—Extending from the summit



of one spinous process to that of another, in the whole line from the seventh cervical vertebra to the middle crest of the sacrum; thick in the lumbar region, but thin and narrow in the dorsal one; formed of longitudinal fibres, which are attached to two, three, four, or five vertebræ, according to their superficial, central, or deep situation.

## 2. ARTICULATIONS OF THE THORAX.

*Articulation of the cartilages of the true ribs with the sternum.*—This is effected between the facets of the internal extremities of these cartilages and the cavities of the lateral borders of the sternum, and is maintained, 1st, By an *anterior*, thin, broad, and triangular ligament, composed of radiating fibres, fixed on one side to the internal extremity of the cartilage, and on the other to the cutaneous surface of the sternum, where it interlaces with those of the opposite side; 2d, By a *posterior ligament*, not so thick as the former, radiating in the same manner, attached by its summit to the posterior part of the internal extremity of the cartilage, and by its base to the posterior face of the sternum, where it is confounded with other fibres of the same nature; 3d, By a *synovial membrane* of small extent, rather looser in the two or three inferior articulations than in the superior, not existing in that of the first cartilage; 4th, By a *costo-xiphoid ligament*, a small, fibrous, elongated, thin fasciculus, fixed superiorly to the inferior border of the seventh cartilage, inferiorly to the anterior surface of the xiphoid cartilage.

*Articulations of the cartilages of the false ribs.*—The sixth and seventh cartilages, the latter and the eighth, articulate by their adjacent edges by means of facets covered with synovial capsules. The last sternal cartilage and the first three abdominal cartilages are united by ligamentous fibres, the last two by the muscles alone.

*Costo-vertebral articulations.*—The means of union of the posterior extremity of the ribs with the bodies



of the vertebræ, are, 1st, By an anterior ligament, a thin, flattened, irregularly quadrilateral fibrous fasciculus, which is radiated, fixed exteriorly around the anterior part of the head of the rib, attached on the inner side, by its superior fibres, to the body of the vertebra above it, and by its inferior ones to that of the vertebra beneath it, and by its middle fibres to the intermediate fibro-cartilage; 2d, By an *interarticular ligament*, a more or less thick, flattened, or rounded fibrous fasciculus, fixed by one part to the prominent line which separates the two surfaces of the posterior extremity of the rib, and by the other to the angle of the cavity in the bodies of the vertebræ; not existing in the articulation of the first, eleventh, and twelfth ribs; 3d, By *two synovial capsules*, folded on the superior and inferior halves of each articulation, and separated by the interarticular ligament; there exists but one synovial capsule in the articulations deprived of this latter ligament.

*Costo-transverse articulations.*—These take place between the tuberosity of the ribs and the summit of the transverse processes of the dorsal vertebræ, and present, 1st, A *posterior costo-transverse ligament*, with parallel close fibres, fixed by one part to the summit of the transverse process, and by the other to the unarticulating portion of the corresponding costal tuberosity; 2d, By a *middle costo-transverse ligament*, formed of irregular fibres, rather cellular than ligamentous, placed between the anterior surface of each transverse process and corresponding rib; 3d, By an *inferior costo-transverse ligament*, composed of parallel and numerous fibres, attached superiorly to the inferior part of each transverse process, inferiorly to the superior border of the rib beneath it near its vertebral articulation; not existing in the articulations of the first and last ribs; 4th, By a synovial membrane, which covers the articulating surfaces.

### 3. ARTICULATIONS OF THE PELVIS.

*Sacro-vertebral articulation.*—Entirely similar to the articulation of the vertebræ with one another; it

takes place between the inferior surface of the last rib and the base of the sacrum, and presents an inter-articular fibro-cartilage, anterior and posterior vertebral ligaments, a ligamentum sub-flavum, an inter-spinous ligament, the termination of the supra-spinous, and, in addition, a sacro-vertebral ligament, strong and short, fixed superiorly to the infero-anterior part of the transverse process of the last lumbar vertebra, inferiorly to the superior part of the sacrum; it is directed obliquely from above downward, and from within outward.

*Vertebro-iliac articulation.*—The last vertebra and os ilium do not touch; they are united by an ilio-lumbar ligament, broad and thick on the inner side, thin and narrow on the outer, triangular and horizontal, fixed on the inner side to the summit of the transverse process of the last vertebra, and on the outer side to the postero-superior iliac spine.

*Sacro-coccygean articulation.*—The summit of the sacrum and base of the os coccygis are articulated by two surfaces, by means, 1st, Of a *fibro-cartilage*, thin, and similar to that of the vertebræ; 2d, Of an *anterior sacro-coccygeal ligament*, formed of irregular delicate fibres, directed from the sacrum to the anterior surface of the os coccygis; 3d, Of a *posterior sacro-coccygeal ligament*, better marked than the preceding, triangular, flattened, broader superiorly than inferiorly, attached superiorly to the borders of the groove, which terminates the sacral canal, inferiorly to the posterior surface of the os coccygis.

*Sacro-iliac articulation.*—This articulation is formed, 1st, By the *great sacro-sciatic ligament*, triangular, thin, flattened, narrower in the middle than at the extremities; fixed by its base to the postero-inferior iliac spine, to the sacro-spinous ligament, to the last posterior tubercles of the sacrum, to the sides of the latter bone, and to those of the os coccygis; by its summit to the ischiatic tuberosity, which is directed obliquely downward, outward, and a little forward; formed of numerous fibres, converging from the sacrum to the ischiatic tuberosity; 2d, By the *lesser*

*sacro-sciatic ligament*, smaller than the preceding, situated in front of it, triangular, with fibres nearly horizontal; fixed, within, to the sides of the sacrum and os coccygis, and without, to the ischiatic spine; 3d, By the *sacro-spinous ligament*, a strong, flattened, vertical fasciculus, fixed on one side to the postero-superior spine of the os ilium, and on the other to the lateral and posterior parts of the sacrum, on a level with the third sacral foramen; 4th, By the *sacro-iliac ligament*, formed of numerous dense fibres, of different directions, placed behind the sacro-iliac articulation, fixed, on the inner side, to the first two eminences of the posterior surface of the sacrum, and to the sides of this bone; on the outer side, to the internal surface of the tuberosity of the ilium.

*The symphysis pubis*.—This is formed by the union of two oval surfaces which the ossa ilia present anteriorly, strengthened by interarticular transverse fibres, which form concentric layers; these latter do not exist at the posterior part of the articulation, where we observe two small portions incrustated with cartilage, and moistened by a white or yellowish liquid. This articulation has two ligaments; 1st, The sub-pubic ligament, a thick, triangular fasciculus, occupying the superior part of the pubic arch, which it completes, attached on each side to the superior internal part of its two branches; 2d, The anterior pubic ligament, an irregular fibrous surface, crossing with the aponeuroses of the abdominal muscles and with the periosteum, formed of superficial fibres, which are directed from the upper part of the symphysis pubis to the front of its branches, and of transverse fibres, uniting with the interarticular plates.

Underneath the body of the pubis we perceive the obturator ligament, a fibrous membrane inserted into the circumference of the obturator foramen, which it closes in, except superiorly, where the notch exists.

## OF THE ARTICULATIONS OF THE EXTREMITIES.

## I. SUPERIOR EXTREMITY.

## ARTICULATION OF THE SHOULDER.

*Sterno-clavicular articulation.*—The clavicle and sternum are united together by two surfaces, incrustated with cartilage, and maintained in situ; 1st, By an *anterior* ligament, a broad fasciculus, with parallel fibres, fixed superiorly in front of the extremity of the clavicle, inferiorly to the margin of the articulating cavity of the sternum; 2d, By a *posterior* ligament, not so broad as the preceding, composed also of parallel fibres, attached on one side to the posterior part of the internal extremity of the clavicle, on the other to the posterior part of the articulating cavity of the sternum; 3d, By a *costo-clavicular* ligament, a short, strong, flattened fasciculus, and fixed inferiorly to the cartilage of the first rib, superiorly to a rough space on the inferior surface of the clavicle; 4th, By an *inter-clavicular* ligament, transverse, flattened, thin, extending between the extremities of the two clavicles above the sternum, and attached to the superior part of each of their extremities; 5th, By a fibro-cartilage, rounded, uniting by its circumference to the preceding ligaments, thin in the centre, where it is sometimes pierced by a foramen; placed between the two articulating surfaces. This articulation has two synovial membranes, separated by the fibro-cartilage, folded, the one on the articulating surface of the clavicle and superior surface of the cartilage, the other on the inferior surface of the cartilage and articular cavity of the sternum.

*Scapulo-clavicular articulation.*—The scapular extremity of the clavicle and acromion process are articulated; 1st, By a *superior* ligament, a strong, quadrilateral fasciculus, with parallel fibres, fixed on one side above the external extremity of the clavicle, on the other to the superior part of the acromion; 2d, By an *inferior* ligament, less distinct than the prece-

ding; its fibres are looser and less numerous, and are fixed to the borders of the articular surfaces; 3d, By a synovial membrane, folded on the two articulating surfaces; 4th, By a coraco-clavicular ligament, very strong, irregular, and large, inserted inferiorly into the postero-external part of the coracoid process; it is formed of a conoid fasciculus, with close diverging fibres, fixed to the tuberosity on the outer side of the inferior face of the clavicle, and of another which is external, and which is longer and broader, is quadrilateral, and is attached to an oblique line, which goes from the preceding tuberosity to the extremity of the clavicle.

*Ligaments proper to the scapula.*—Two in number; 1st, The *coracoid* ligament, thin, narrow in the middle, broader at its extremities, extending between the two extremities of the notch in the scapula behind the base of the coracoid process; 2d, The *coraco-acromion* ligament, a strong, triangular, flattened fasciculus, fixed on the inner side to the outer edge of the coracoid process by two fasciculi, which are directed forward and outward, and which unite in a single fasciculus, and are fixed to the summit of the acromion process,

#### ARTICULATION OF THE ARM.

*Articulation of the scapula and humerus.*—The head of the humerus is received into the glenoid cavity of the scapula, and maintained there, 1st, By a *glenoid* ligament, a species of oval fibrous bursa, placed on the circumference of the glenoid cavity, formed in part of its proper fibres, and partly by the division of the tendon of the biceps; 2d, By a *capsular* ligament, in the form of a sac without an opening, conical, corresponding by its base to the neck of the humerus, by its summit to the glenoid cavity; fixed superiorly around this latter cavity above the glenoid ligament, inferiorly around the neck of the humerus, where it blends superiorly with the tendon of the supra-spinatus muscle, on the outer side with that of the infra-spinatus, on the inner side with that of the sub-scapularis; 3d,

By a *coraco-humeral* ligament, a dense fasciculus, fixed to the external edge of the coracoid process, and to the anterior part of the great tuberosity of the humerus, where its fibres become blended with those of the tendon of the infra-spinatus muscle; 4th, By a *synovial* membrane, which covers the glenoid cavity, the capsular ligament, a portion of the tendon of the infra-spinatus, and the cartilage of the head of the humerus, extending itself into the bicipital groove, and enveloping the tendon of the biceps.

*Humero-cubital articulation.*—The inferior extremity of the humerus, and superior extremities of the radius and ulna, form two ranges of cavities and eminences, receiving one another reciprocally; and are united, 1st, By an *external lateral* ligament, rounded with parallel compact fibres, fixed superiorly to the summit of the external condyle of the humerus, inferiorly to the annular ligament of the radius; 2d, By an *internal lateral* ligament, longer and broader than the preceding, formed of two fasciculi, the one anterior, attached superiorly to the internal tuberosity of the humerus, inferiorly to the corresponding side of the coronoid process of the ulna; the other posterior, having the same insertion superiorly, and fixed inferiorly to the internal side of the olecranon process; 3d, By two ligaments, one *anterior*, the other *posterior*, both thin, irregular, membranous, in the form of a fibrous band, placed, the one in front, the other behind the articulation; the former is attached in front of the internal condyle of the humerus and to the annular ligament of the radius; the latter, to the posterior part of the external and internal condyles of the humerus; 4th, By a *synovial membrane*, which covers successively the cavity for the olecranon, the olecranon process, the sigmoid cavity, the superior part of the radius, the space between the two bones of the fore-arm, the internal part of the annular ligament, the neck of the radius, the anterior fibres of the articulation, the coronoid cavity, and the articular eminences and cavities of the humerus.

## ARTICULATIONS OF THE FORE-ARM.

*Radio-cubital articulation.*—The radius and ulna are united immediately at their extremities, and medially at their middle part.

*Superior articulation.*—This is effected between a part of the circumference of the head of the radius and the small sigmoid cavity of the ulna; it is maintained by an annular ligament, a strong, narrow, flat, and dense fasciculus, composed of circular fibres, which are attached to the anterior border of the small sigmoid cavity, pass round the circumference of the neck of the radius, and are inserted into the posterior border of this cavity.

*Middle articulation.*—The bones of the fore-arm do not touch in their middle portion; they are united in this region, 1st, By the interosseous ligament, a thin, fibrous membrane, which is not so long as the interosseous space which it occupies; commencing beneath the bicipital tuberosity; fixed to the external border of the ulna and to the internal border of the radius; formed of glistening parallel fibres inserted obliquely into these bones; 2d, By a round ligament, a delicate, long, rounded, fibrous cord, fixed superiorly to the coronoid process, inferiorly to the bicipital tuberosity of the radius; directed obliquely from above downward, and from within outward.

*Inferior articulation.*—This takes place between the head of the ulna and a concave facet on the inferior extremity of the radius. The means of union are some scarcely apparent anterior and posterior fibres, and 1st, a thin, narrow, and triangular fibro-cartilage, formed of diverging fibres, more cartilaginous superiorly than inferiorly, fixed by its summit to a depression which separates the styloid process of the ulna from its articulating surface, and by its base to the border which separates the two articulating surfaces of the radius, uniting anteriorly and posteriorly with the fibres of the radio-carpal articulation; 2d, a synovial membrane, very loose both anteriorly and



posteriorly, which covers the fibro-cartilage and the articulating surfaces of the radius and ulna.

*Radio-carpal articulation.*—The inferior extremity of the radius and the fibro-cartilage of the ulna articulate with a convex surface formed by the scaphoid, semilunar, and cuneiform bones. These surfaces are covered with cartilage, and are kept in place, 1st, By an *internal lateral ligament*, fixed superiorly to the styloid process of the ulna, inferiorly to the os cuneiforme; 2d, By an *external lateral ligament*, inserted superiorly into the styloid process of the radius, inferiorly into the scaphoid bone; 3d, By an *anterior ligament*, which is broad and flat, and is attached superiorly in front of the inferior extremity of the radius, inferiorly and on the inner side to the anterior part of the os scaphoides, semilunar, and os cuneiforme; 4th, By a *posterior ligament*, not so broad as the preceding, but more distinct, and inserted on one side behind the inferior extremity of the radius, on the other to the posterior part of the semilunar and cuneiform bones; 5th, By a *synovial membrane*, which covers the entire part of the articulation.

#### ARTICULATION OF THE HAND.

*Articulations of the first range of the carpal bones.*—The first three bones of the carpus are united together by surfaces covered with cartilage, and kept in place, 1st, By *interosseous ligaments*, thin, dense, fibrous layers, placed in the intervals between the scaphoid, semilunar, and cuneiform bones; 2d, By *transverse dorsal ligaments*, one extending between the scaphoid and semilunar bone, the other between this latter and the cuneiform; 3d, By *palmar ligaments*, similar to the preceding. The articulation of the pisiform with the cuneiform bone is covered by a *synovial membrane*, and by two distinct fibrous fasciculi, attached on one side to the inferior portion of the pisiform bone, on the other, the external to the process of the unciform bone, the internal to the superior part of the last metacarpal bone.



*Articulation of the second range.*—The contiguous bones of this range are united, 1st, By dorsal and palmar ligaments, three on each side, extending transversely forward and backward, from the os trapezium to the trapezoides, from this latter to the os magnum, and from the os magnum to the os unciforme; 2d, By two interosseous ligaments, one between the trapezoides and os magnum, and the other between the latter bone and os unciforme.

*Articulation of the two ranges of the carpus.*—1st, By two short lateral ligaments, one external, more apparent, extending from the external part of the os scaphoides to the trapezium; the other internal, proceeding from the os cuneiforme to the unciforme; 2d, By two ligaments, one anterior, the other posterior, formed of delicate fibrous bands, fixed, the one in front, the other behind the two ranges of the carpal bones, blended with the neighbouring ligaments.

*Carpo-metacarpal articulations.*—The articulation of the first metacarpal bone with the trapezium is effected, 1st, By a capsular ligament with longitudinal fibres, attached round the articulating surface of this latter bone, and the superior extremity of the former; 2d, By a synovial membrane, folded on the two articulating surfaces and capsular ligament. The last four bones of the metacarpus and the second range of the carpus are articulated by cartilaginous surfaces, covered by a prolongation of the synovial membrane of the carpus, and kept in place, 1st, By *dorsal* ligaments, thin and flat fasciculi, extending from the second range of the carpus to the posterior part of the upper extremity of the last four metacarpal bones; 2d, By palmar ligaments, arranged like the preceding.

*Metacarpal articulations.*—The last four bones of the metacarpus are united; 1st, By three dorsal ligaments, directed transversely from one metacarpal bone to the other; 2d, By superior palmar ligaments, three in number, and similar to the preceding, transverse, passing from one bone to the other, sending prolongations between the bones; 3d, By an inferior palmar ligament, a transverse fibrous band, which extends in

front of the inferior extremity of the last four metacarpal bones, to which its fibres are attached.

*Articulation of the metacarpal bones with the phalanges.*—The heads of the metacarpal bones are articulated with the concave surfaces of the superior extremities of the first phalanges; 1st, By an anterior ligament, semicircular, embracing the anterior part of each articulation, attached on each side to the metacarpal bone in front of the lateral ligaments, partly confounded in front with the anterior palmar ligament and with the sheath of the tendon of the flexors; 2d, By lateral ligaments, distinct, rounded, with parallel fibres, fixed superiorly to the lateral parts of the inferior extremity of each metacarpal bone, inferiorly to the sides of the superior extremity of each phalanx; 3d, By a synovial membrane, folded on all parts of the articulation.

*Articulation of the phalanges.*—Each finger has two, except the thumb, which has but one. The condyles of the inferior extremity of the first and second phalanges are articulated with the corresponding cavities of the upper ends of the second and third phalanges; 1st, By an anterior ligament, similar to that of the preceding articulation, semicircular, attached to both sides of the extremity of the phalange above, and receiving in front many fibres coming from the sheath of the tendon of the flexors; 2d, By lateral ligaments, fixed on each side behind the preceding; they resemble those of the articulations of the metacarpal bones with the phalanges, except that they are fixed superiorly to one phalanx; 3d, By a synovial membrane, which covers the articulating surfaces and the ligaments.

## 2. ARTICULATION OF THE INFERIOR EXTREMITIES.

*Ilio-femoral articulation.*—This is formed by the head of the femur received into the acetabulum of the os ilium; and maintained, 1st, By a *cotyloid* ligament, a broad, thick, circular fibrous band, placed on the circumference of the cavity, uniting on the outer side with the capsule, covered on the inner side by

the synovial membrane; 2d, By a *capsular* ligament, in the form of a sac with two openings, broader around the acetabulum than around the neck of the femur, rounded superiorly, flattened and quadrilateral inferiorly; attached superiorly to the exterior of the circumference of this cavity beyond the cotyloidean ligament, and to this ligament itself on a level with the notch; inferiorly, around the base of the neck of the femur to the anterior and posterior oblique lines, which descend inward and a little backward from the great trochanter to the lesser one; directed from above downward and from within outward, very thick in front and on the outer side, thin and weak on the inner, embracing the articulating surfaces and neck of the femur; 3d, By an *interarticular* ligament, a triangular, flat, fibrous fasciculus, fixed superiorly to the rough depression on the head of the femur, inferiorly to the extremities of the inferior notch of the acetabulum by two fasciculi, which are separated from one another; 4th, By a *synovial* membrane, folded in the acetabulum on the cellular tissue which it contains, on the cotyloidean ligament, the internal surface of the fibrous capsule, the neck of the femur, and the head of this bone, at the summit of which it embraces the interarticular ligament.

*Articulation of the femur with the tibia.*—This is formed by the junction of the condyles of the femur with the superior extremity of the tibia, and by the contact of the patella with the anterior concave surface of these condyles. These three articular surfaces are covered with cartilage, and are united by bands, one of which belongs to the patella, the other to the tibia and fibula: 1st, These are the *ligamentum patellæ*, a thick, long, flattened fibrous fasciculus, attached superiorly to the inferior angle of the patella and to the depression behind it, inferiorly to the eminence at the superior extremity of the anterior border of the tibia; formed of parallel, whitish, compact, and tendinous fibres; 2d, The *external lateral* ligament, a round fibrous cord of a tendinous aspect, fixed superiorly to the external condyle of the femur,

inferiorly to the superior extremity of the fibula ; 3d, The *internal lateral ligament*, flat and membranous, extending from the internal condyle of the femur to the superior part of the edge and internal surface of the tibia ; 4th, The *posterior ligament*, extending obliquely from the internal tuberosity of the tibia to the external condyle of the femur, and covered by an aponeurotic expansion, which comes from the semimembranosus muscle ; 5th, The *crucial ligaments*, strong fibrous cords, situated at the posterior part of the articulation, crossing one another, divided into an anterior, which is fixed on one side to the inner part of the external condyle, on the other to the anterior notch of the spine of the tibia ; and into a posterior, attached by one extremity to the external part of the internal condyle, and by the other to the rough depression situated behind the spine of the tibia and to the posterior part of the external fibro-cartilage ; 6th, Two semilunar interarticular cartilages, placed between the condyles of the femur and articulating surfaces of the tibia ; flattened from above downward ; in the form of a crescent ; their great circumference thick, their small one thin ; the internal semicircular, the external forming nearly an entire circle, both adhering by their great circumference to the ligaments of the articulation ; fixed by their posterior extremities behind the spine of the tibia in front of the insertion of the posterior crucial ligament, and by their anterior in front of the same eminence and anterior crucial ligament ; formed of concentric fibres ; 7th, The *synovial membrane* : this covers the anterior and inferior parts of the condyles, the anterior part of the tendons of the gastrocnemii muscles, the tendon of the popliteus, the crucial ligaments, the articulating surface of the tibia, the semilunar cartilages, the inferior ligamentum patellæ, a large quantity of surrounding cellular tissue, and lastly, the posterior surface of the patella and tendon of the triiceps crural muscle.

## ARTICULATIONS OF THE LEG.

*Articulation of the tibia with the fibula.*—*Superior articulation.*—1st, By an anterior ligament, formed of parallel fibres, attached to the anterior part of the fibula and to the front of the external tuberosity of the tibia; 2d, By a posterior ligament, narrower than the preceding, extending from the posterior part of the external condyle of the femur to the posterior part of the head of the fibula; 3d, By a synovial membrane, which covers the articulating surfaces. *Middle articulation.*—Between the bones of the leg, the tibia, and the fibula, we observe an interosseous ligament, similar to that of the fore-arm, thin, flat, and aponeurotic, occupying the interval of these two bones; composed of oblique fibres, which, from the external border of the tibia, are directed towards a crest on the internal surface of the fibula, and to the internal border of this bone. *Inferior articulation.*—The bones of the leg are articulated inferiorly by two triangular surfaces, covered by a synovial membrane, and kept in place, 1st, By an *anterior* ligament, which is triangular, broader inferiorly than superiorly, fixed in front of the tarsal extremity of the fibula, and in front of the neighbouring part of the tibia; 2d, By a posterior ligament, similar to the preceding, attached to the posterior part of the inferior extremity of the fibula and to the neighbouring part of the tibia; 3d, By an interosseous ligament, formed of dense, short fibres, placed in the space between the faces of the articulation above these cartilages.

*Articulation of the tibia with the tarsus.*—The astragalus is received into a cavity formed by the fibula and tibia; the articulating surfaces are kept in place, 1st, By an internal lateral ligament, fixed superiorly to the summit of the malleolus, and inferiorly to the internal part of the astragalus; 2d, By an external lateral ligament, narrow, rounded and thick, inserted into the antero-superior part of the external malleolus, inferiorly into the external side of the calcane-

um; 3d, By two anterior ligaments, the one external, regular, quadrilateral, attached to the front of the external malleolus, and to a depression observed at the external part of the astragalus; the other internal, irregular, indistinct, extending from the anterior part of the inferior extremity of the tibia to the anterior part of the astragalus; 4th, By two posterior ligaments, the one external, inserted into the posterior part of the external malleolus and into the posterior part of the astragalus; the other internal, extending from the external malleolus to the internal; 5th, By a synovial membrane, folded on the surfaces and ligaments of the articulation.

#### ARTICULATIONS OF THE FOOT.

*Articulation of the calcaneum with the astragalus.*—The calcaneum and astragalus are articulated by two facets, covered with cartilage, and a synovial membrane, and kept in place, 1st, By an *interosseous* ligament, formed of a thick fasciculus of dense fibres, attached by one part to the groove which separates the two surfaces of the astragalus, and by the other to that which is between the surfaces of the calcaneum; 2d, By a *posterior* ligament, composed of parallel fibres, inserted into the posterior part of the astragalus and into the neighbouring part of the calcaneum.

*Articulation of the calcaneum with the os naviculare.*—The calcaneum is united to the naviculare, 1st, By an inferior ligament, a thick, flat fasciculus, oblique from without inwards; fixed by one part to the anterior portion of the small tuberosity of the calcaneum, and by the other to the inferior part of the os naviculare; 2d, By an external ligament, very short, extending from the anterior internal part of the calcaneum to the external inferior part of the os naviculare.

*Articulation of the os naviculare with the astragalus.*—The head of the astragalus is received into a cavity formed by the os naviculare, by a small surface of the calcaneum, and by the preceding ligaments. This

articulation presents, 1st, A thin, broad ligament, attached to the border and upper part of the articulating surface of the astragalus, and to the superior part of the os naviculare; 2d, A synovial membrane, folded on the articulating surfaces and on the ligaments.

*Articulation of the calcaneum with the os cuboides.*—This is effected, 1st, By a superior ligament, thin, broad, quadrilateral, extending from the supero-anterior part of the calcaneum to the superior part of the os cuboides; 2d, By an inferior ligament, thick and long, and composed of two planes of fibres; of these one is superficial, and is attached posteriorly to the postero-inferior parts of the calcaneum, anteriorly partly to the tuberosity of the inferior face of the cuboid bone, and partly to the extremity of the third and fourth metatarsal bones; the other, deeper, fixed to the calcaneum in front of the superficial layer, and to the inferior part of the cuboid bone; 3d, By a synovial membrane, which covers the articulating surfaces and the two preceding ligaments, and is contiguous on the outer side with the sheath of the peroneus longus muscle.

*Articulation of the os naviculare with the cuboides.*—This is effected, 1st, By a dorsal, transverse, quadrilateral ligament, extending from the naviculare to the cuboid bone; 2d, By a plantar ligament, rounded, extended obliquely from the inferior external part of the naviculare to the adjacent part of the cuboid bone.

*Articulation of the os cuneiforme with the os cuboides.*—The cuboid and third cuneiform bones are united by two surfaces, and kept in place By a thin, oblique, and dorsal ligament, fixed to the superior part of the neighbouring border of the two bones; 2d, By a plantar ligament, thicker than the former, attached to the internal part of the cuboid and to the inferior surface of the third cuneiform bone.

*Articulation of the os naviculare with the cuneiform.*—The three facets of the naviculare are articulated with those of the three cuneiform bones, 1st, By three



dorsal ligaments, thin, flattened, attached posteriorly to the superior part of the os naviculare, where they are united, separated from one another in front, and fixed to the superior surface of each cuneiform bone ; 2d, By three plantar ligaments, similar to the preceding, extending from the inferior part of the naviculare to the inferior surfaces of the three cuneiform bones ; 3d, By a synovial membrane, folded on the three articulating surfaces, and on the plantar and dorsal ligaments.

*Articulation of the cuneiform bones.*—The cuneiform bones are articulated by their lateral surfaces, covered by the synovial membrane of the preceding articulation, and maintained by three superior ligaments, extending transversely over their superior surfaces ; and by inferior ligaments, similar to the preceding, but less distinct.

*Articulations of the tarsal with the metatarsal bones.*—The first three bones of the metatarsus are articulated with the three cuneiform, and the last two with the os cuboides. They are kept in place by dorsal ligaments ; one, extending from the superior part of the first cuneiform to the extremity of the first metatarsal bone ; three others, from the three cuneiform bones to the upper part of the extremity of the second metatarsal bone ; another, inserted into the third cuneiform and third metatarsal bone ; and the two last, attached to the superior part of the os cuboides and to the corresponding side of the extremity of the fourth and fifth metatarsal bones by plantar ligaments similar to the preceding.

*Articulations of the metatarsal bones.*—All the bones of the metatarsus except the first are articulated together at their posterior extremities by small cartilaginous facets, covered by prolongations of the synovial membranes of the preceding articulations, and maintained, 1st, By dorsal and plantar ligaments, three in each region, extending transversely from the second to the third, from this to the fourth, and so on ; 2d, By interosseous fibres, placed between the unarticulated points of the posterior extremities of



these bones ; 3d, By a transverse ligament, situated beneath the anterior extremities of the metatarsal bones, entirely similar to that of the metacarpus.

*Articulations of the metatarsus with the phalanges.*—The posterior extremities of the first phalanges articulate with the head of the bones of the metatarsus ; they are provided with two lateral and an anterior ligament, similar to those of the articulations of the metacarpus and phalanges.

*Articulations of the phalanges.*—These are similar to those of the fingers.

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## CLASS II.

### OF THE MUSCLES AND THEIR APPENDAGES.

THE muscles, like the bones, must be studied in respect to their general and their descriptive anatomy.

### ARTICLE I.

#### *Of the Muscular System.*

*Definition.*—The muscles are soft organs of a reddish colour, varied in their form, and composed of very marked fibres, commonly termed *flesh*, forming the greater part of the body, the functions of which are to produce, by their contractions, all the apparent motions of the organism. *Division.*—The muscles are divided into two kinds : the external muscles, which are more or less thick, and which act under the influence of the will ; and the internal muscles, which are generally membraniform, and the contractions of which are involuntary.

*Situation.*—The external, or voluntary muscles cover the skeleton, to which they are attached, and in turn are covered by the skin. *Form.*—Their size is very variable. In regard to form, they are divided

into long, broad, and short. The first are found more particularly in the limbs, the second in the trunk, the third in the head, neck, hands, and feet. Most of the muscles have two tendinous or aponeurotic extremities, one of which is called the *head*, and the other the *tail*. Their central part is termed the *belly*. The muscles on each side of the median line are arranged in pairs. Their extremities are attached to the periosteum, perichondrium, and organs of sense.

*Structure of the voluntary muscles.*—The muscles are collections of primitive microscopic fibres, united in fasciculi. The latter unite, and form still larger bundles. The direction of the fibres varies much. Sometimes they are parallel to each other, sometimes radiated or oblique. In the structure of the muscles we find cellular tissue, vessels, and nerves. The first forms a kind of sheath for the fibres and fasciculi of the muscles, and an envelope for each of these organs. Their vessels are numerous and large. Their nerves are very numerous, and arise from the spinal marrow. *Vital properties and functions.*—The sensibility of the muscles is but slightly marked: they alone possess the power of contracting when the will commands it, and of thus producing all the voluntary motions. This property is termed *voluntary contractility*.

## ARTICLE II.

### *Of the Appendages of the Muscles.*

#### 1. OF THE TENDONS.

*Definition.*—The *tendons* are fibrous and ligamentous organs, of a pearly lustre, dry and inextensible; they unite the muscles to the bones and cartilages, and also to portions of the same muscle. *Division.*—The tendons are divided, according to their forms, into *funicular* tendons and *aponeurotic* tendons. *Situation.*—The tendons are generally situated at the extremities of the muscles, and are attached on one

side to the muscles and on the other to the hard parts, or to the enveloping aponeuroses: sometimes the continuity of the fleshy fibres is interrupted. Their mode of insertion varies much. *Formation.*—The *funicular* tendons are more or less elongated, round, or flattened cords. The aponeurotic tendons are broader, and are arranged in the form of membranes. *Structure.*—The tissue of the tendons is very compact; their fibres are united by a little cellular tissue. *Functions.*—The tendons are the means by which the muscles are inserted in the hard parts.

## 2. OF THE APONEUROSES.

*Definition.*—The aponeuroses are firm and resisting fibrous membranes, of a pearly white colour, which cover one or more muscles, more or less perfectly. *Division.*—The aponeuroses are general and partial. The first belong to the limbs, the second to the trunk. The general aponeuroses have the form of the limbs which they envelop. Their inner face is in contact with these latter, and sends between them membranous prolongations, which separate them, and give insertion to their fibres; the external is covered by the skin; their extremities are attached to the periosteum.

The partial aponeuroses cover or envelop imperfectly certain muscles of the parietes of the splanchnic cavities. For instance, the temporal and abdominal aponeuroses.

The aponeuroses have tensor muscles, which extend or relax them, according to the state of the muscles.

## 3. OF THE TENDINOUS SHEATHS.

*Definition.*—The sheaths of the tendons are a kind of bands of fibrous tissue, which either alone or with the aid of the adjacent bones form a kind of canal, in which one or more tendons glide. *Situation.*—They are placed principally at the free extremity of

the limbs, and they are more numerous in the direction of flexion than in that of extension. *Formation*.—Some of the sheaths receive only one tendon, others envelop several. Some form an entire canal by themselves. Others present only fibrous rings, and are called *annular ligaments*. *Functions*.—Their function is to keep the tendons in place.

## ARTICLE III.

### *Myology.*

[*Preparation*.—The dissection of the muscles is generally easy. It consists in detaching the skin which covers them, and in removing the cellular tissue and fat which surround them without disturbing the fleshy fibres.]

In order to study all the muscles on the same subject, they must be dissected in the following order. *Platysma myoides*, *sternocleido-mastoidæus*, *digastricus*, *stylo-hyoideus*, *stylo-glossus*, *mylo* and *genio-hyoideus*, *hyo* and *genio-glossus*, *lingualis*, *sterno-hyoideus*, *sterno-thyroideus*, *thyro* and *omo-hyoideus*, *frontalis*, *occipitalis*, *superior*, *anterior*, and *posterior auricular muscles*, *orbicularis palpebrarum*, *corrugator supercilii*, *levator palpebræ superioris*, *attollens oculi*, *depressor oculi*, *adductor oculi*, *abductor oculi*, *obliquus superior et obliquus inferior oculi*, *pyramidalis nasi*, *compressor nasi*, *levator labii superioris alæque nasi*, *depressor alæ nasi*, *levator labii superioris*, *masseter*, *zygomaticus major et minor*, *depressor anguli oris*, *depressor labii inferioris*, *levator menti*, *buccinator*, *orbicularis oris*, *masseter*, *temporalis*, *pterygoideus internus et externus*, *constrictor pharyngis superior*, *medius et inferior*, *stylo-pharyngeus*, *circumflexus palati*, *levator palati*, *azygos uvulæ*, *palato-pharyngeus*, *constrictor isthmii faucium*, *trapezius*, *latissimus dorsi*, *rhomboideus*, *splenius*, *complexus major et minor*, *serratus posticus inferior et superior*, *interspinales cervicis*, *intertransversarii colli et lumborum*, *semi-spinalis dorsi et multifidus spinæ*, *sacro lumbalis*, *transversalis colli*, *longissimus dorsi*, *pectoralis major et minor*, *subclavius*, *serratus magnus*, *obliquus abdominis externus et internus*, *transversalis abdominis*, *rectus abdominis*, *pyramidalis*, *quadratus lumborum*, *diaphragma*, *levatores costarum*, *intercostales externi et interni*, *triangularis sterni*, *scalenus anticus et posticus*, *rectus capitis anticus major et minor*, *rectus capitis posticus major et minor*, *obliquus capitis inferior et superior*, *rectus capitis lateralis*, *intertransversales colli*, *longus colli*, *psoas parvus et magnus*, *iliacus internus*, *inter-transversales lumborum*, *levator ani*, *ischio-coccygeus*, *sphincter ani*, *muscles of the genital region*, *deltoides*, *supra et infra-spinatus*, *teres minor et major*, *subscapularis*, *coraco-*

brachialis, biceps brachii, brachialis internus, triceps brachii, supinator radii longus, radialis externus longus et brevior, extensor digitorum communis, extensor proprius minimi digiti, ulnaris externus, anconeus, abductor pollicis, extensor pollicis manus major et minor, indicator, abductor pollicis brevis, opponens pollicis, flexor pollicis brevis, adductor pollicis, palmaris brevis, adductor minimi digiti, flexor parvus minimi digiti manus, adductor metacarpi minimi digiti, pronator teres, palmaris longus et brevis, ulnaris internus, flexor digitorum communis sublimis et profundus, flexor pollicis longus, pronator quadratus, lumbricales, interossei, supinator brevis, glutæus maximus, medius et minimus, pyramidalis, gemelli, quadratus lumborum, semi-membranosus, semi-tendinosus, biceps cruris, sartorius, rectus femoris, triceps cruris, pectineus, gracilis, adductor longus, brevis et magnus, tensor vaginæ femoris, obturator externus et internus, tibialis anticus, extensor pollicis pedis proprius, peroneus tertius, gastrocnemius, soleus, plantaris, popliteus, pedicæus, adductor pollicis pedis, flexor brevis et abductor pollicis pedis, abductor et flexor brevis minimi digiti pedis, flexor digitorum pedis communis perforans et perforatus, tibialis posticus, flexor accessorius, lumbricales, peroneus longus et medius, and finally, the interosseous muscles.

## DIVISION OF THE MUSCLES.

The total number of the muscles amounts to 512, of which 254 are pairs, and lie on each side of the body; and four are single, situated on the median line. To these may be added the six muscles of the tympanum and the nine muscles of the larynx, making in all 527. The following table presents the nomenclature and distribution of the muscles.

### I. MUSCLES OF THE HEAD. (39.)

#### 1. MUSCLES OF THE CRANIUM. (4.)

- |                                |  |
|--------------------------------|--|
| 1. Cranial region, (1 muscle.) | { Occipito frontalis.                                  |
| 2. Auricular region, (3 m.)    | { Superior, anterior, and posterior auricular muscles. |

#### 2. MUSCLES OF THE FACE. (35.)

- |                             |  |
|-----------------------------|--|
| 1. Palpebral region, (3 m.) | { Orbicularis palpebrarum, corrugator supercilii, levator palpebræ superioris. |
|-----------------------------|--|

- |                                      |  |
|--------------------------------------|--|
| 2. Ocular region, (6 m.)             | { Attollens oculi, depressor, adductor, abductor, obliquus superior, obliquus inferior.            |
| 3. Nasal region, (4 m.)              | { Pyramidalis nasi, compressor nasi, levator labii superioris alæque nasi, depressor alæ nasi.     |
| 4. Superior maxillary region, (4 m.) | { Levator labii superioris, levator anguli oris, zygomaticus major, zygomaticus minor.             |
| 5. Inferior maxillary region, (3 m.) | { Depressor anguli oris, depressor labii inferioris, levator menti.                                |
| 6. Intermaxillary region, (2 m.)     | { Buccinator, orbicularis oris.  |
| 7. Pterygo-maxillary region, (2 m.)  | { Pterygoideus internus, pterygoideus externus.  |
| 8. Temporo-maxillary region, (2 m.)  | { Masseter, temporalis.  |
| 9. Lingual region, (4 m.)            | { Hyo-glossus, genio-glossus, stylo-glossus, lingualis.  |
| 10. Palatine region, (5 m.)          | { Circumflexus palati, levator palati, azygos uvulæ, palatopharyngeus, constrictor isthmi faucium. |

## II. MUSCLES OF THE TRUNK. (116.)

### 1. MUSCLES OF THE NECK. (20.)

- |  |   |
|--|---|
| 1. Superficial cervical region, (2 m.) | { Platysma myoides, sterno-mastoideus.                                      |
| 2. Superior hyoidean region, (4 m.)    | { Digastricus, stylo-hyoideus, mylo-hyoideus, genio-hyoideus.               |
| 3. Inferior hyoidean region, (4 m.)    | { Omo-hyoideus, sterno-hyoideus, sterno-thyroideus, thyro-hyoideus.         |
| 4. Pharyngeal region, (4 m.)           | { Constrictor pharyngis inferior, medius, and superior; stylo-pharyngeus.   |
| 5. Deep cervical region, (3 m.)        | { Rectus capitis anticus major, rectus capitis anticus minor, longus colli. |
| 6. Lateral cervical region, (3 m.)     | { Scalenus anticus, et posticus, rectus capitis lateralis.                  |

### 2. MUSCLES OF THE THORAX. (40.)

- |                                     |   |
|-------------------------------------|---|
| 1. Anterior thoracic region, (3 m.) | { Pectoralis major, et minor, subclavius. |
|-------------------------------------|---|

- |                                    |   |  |
|------------------------------------|---|--|
| 2. Lateral thoracic region, (1 m.) | { | Serratus magnus.   |
| 3. Intercostal region, (35 m.)     |   | External and internal intercostals (22), levatores costarum breviores and longiores. |
| 4. Diaphragmatic region, (1 m.)    | { | Diaphragma.  |

3. MUSCLES OF THE ABDOMEN. (17.)

- |                             |   |  |
|-----------------------------|---|--|
| 1. Abdominal region, (5 m.) | { | Obliquus abdominis externus, et internus, rectus abdominis, transversalis, pyramidalis.  |
| 2. Lumbar region, (4 m.)    |   | Psoas magnus, et parvus, iliacus, quadratus lumborum.  |
| 3. Anal region, (3 m.)      |   | Levator ani, coccygeus, sphincter ani.   |
| 4. Genital region.          |   | (In man, 4 m.) Cremaster, erector penis, accelerator urinæ, transversus perinæi. (In woman, 2 m.) Erector clitoridis, constrictor cunni. |

4. MUSCLES OF THE POSTERIOR PART OF THE TRUNK. (39.)

- |   |   |   |
|---|---|---|
| 1. Lumbo-dorsal region, (2 m.)                  | { | Latissimus dorsi, sacro-lumbalis.   |
| 2. Dorso-cervical region, (2 m.)                |   | Trapezius, rhomboideus, levator anguli scapulæ.   |
| 3. Vertebro-costal region, (2 m.)               |   | Serratus posticus superior, et inferior.  |
| 4. Superficial cervico-occipital region, (3 m.) |   | Splenius, complexus, trachelomastoideus.  |
| 5. Deep cervico-occipital region, (4 m.)        |   | Rectus capitis posticus major, et minor, obliquus capitis inferior, et superior.  |
| 6. Vertebral region, (26 m.)                    |   | Longissimus dorsi, sacro-lumbalis, transversalis colli, semi-spinalis dorsi, et multifidus spinæ, interspinales cervicis (6), intertransversarii colli (11), intertransversarii lumborum (5). |

III. MUSCLES OF THE EXTREMITIES. (103.)

1. OF THE SUPERIOR EXTREMITIES. (49.)

MUSCLES OF THE SHOULDER. (6.)

- |                                      |   |  |
|--------------------------------------|---|--|
| 1. Posterior scapular region, (4 m.) | { | Supra-spinatus, infra-spinatus, teres major, et minor. |
|--------------------------------------|---|--|

- |  |   |                 |
|--|---|-----------------|
| 2. Anterior scapular region,<br>(1 m.) | { | Sub-scapularis. |
| 3. External scapular region,<br>(1 m.) |   | Deltoides.      |

## MUSCLES OF THE ARM. (4.)

- |   |   |  |
|---|---|--|
| 1. Anterior brachial region,<br>(3 m.)  | { | Coraco-brachialis, biceps, bra-<br>chialis internus. |
| 2. Posterior brachial region,<br>(1 m.) |   | Triceps brachialis.                                  |

## MUSCLES OF THE FORE-ARM. (20.)

- |   |   |  |
|---|---|--|
| 1. Anterior superficial anti-bra-<br>chial region, (5 m.) | { | Pronator teres, radialis inter-<br>nus, palmaris longus, ulnaris<br>internus, flexor superficialis,<br>vel perforatus. |
| 2. Anterior deep region, (3 m.)                           |   | Flexor profundus, vel perforans,<br>flexor longus pollicis manus,<br>pronator quadratus.                               |
| 3. Posterior superficial region,<br>(4 m.)                | { | Extensor communis digitorum,<br>extensor proprius minimi di-<br>giti, ulnaris externus, anco-<br>neus.                 |
| 4. Posterior deep region, (4 m.)                          |   | Abductor longus pollicis ma-<br>nus, extensor major et minor<br>pollicis manus, indicator.                             |
| 5. Radial region, (4 m.)                                  | { | Supinator radii longus, et bre-<br>vis, radialis externus longior,<br>et brevior.                                      |

## MUSCLES OF THE HAND. (19.)

- |                                      |   |  |
|--------------------------------------|---|--|
| 1. External palmar region,<br>(4 m.) | { | Abductor brevis pollicis manus,<br>opponens pollicis, flexor bre-<br>vis pollicis manus, adductor<br>pollicis manus.           |
| 2. Internal palmar region, (4 m.)    |   | Palmaris brevis, adductor mini-<br>mi digiti, flexor proprius digi-<br>ti minimi, adductor ossis met-<br>acarpi minimi digiti. |
| 3. Middle palmar region,<br>(11 m.)  | { | Lumbricales, interossei interni<br>et externi.   |

## 2. OF THE INFERIOR EXTREMITIES. (54.)

## MUSCLES OF THE THIGH. (21.)

- |                           |   |  |
|---------------------------|---|--|
| 1. Glutæal region, (3 m.) | { | Glutæus maximus, medius et<br>minimus. |
|---------------------------|---|--|



- |                                    |  |
|------------------------------------|--|
| 2. Trochanter region, (6 m.)       | { Obturator externus, et internus, pyramidalis, gemellus superior, et inferior, quadratus femoris. |
| 3. Anterior crural region, (3 m.)  | { Sartorius, rectus femoris, triceps cruris.   |
| 4. Posterior crural region, (3 m.) | { Semi-tendinosus, semi-membranosus, biceps femoris.   |
| 5. Internal crural region, (5 m.)  | { Pectineus, gracilis, adductor longus, magnus, et brevis.   |
| 6. External crural region, (1 m.)  | { Tensor vaginæ femoris.   |

## MUSCLES OF THE LEG. (13.)

- |   |  |
|---|--|
| 1. Anterior tibial region, (4 m.)       | { Tibialis anticus, extensor longus digitorum pedis, extensor proprius hallucis, peroneus tertius. |
| 2. Posterior superficial region, (4 m.) | { Gastrocnemius, soleus, plantaris, popliteus.   |
| 3. Posterior deep region, (3 m.)        | { Flexor longus digitorum, flexor longus hallucis, tibialis posticus.                              |
| 4. Peroneal region, (2 m.)              | { Peroneus longus, et brevis.  |

## MUSCLES OF THE FOOT. (20.)

- |                                    |  |
|------------------------------------|--|
| 1. Dorsal region, (1 m.)           | { Extensor brevis digitorum pedis.   |
| 2. Middle plantar region, (6 m.)   | { Flexor brevis digitorum pedis, massa carnea sylvii, lumbricales.                 |
| 3. Internal plantar region, (4 m.) | { Adductor hallucis, flexor brevis hallucis, abductor hallucis, transversus pedis. |
| 4. External plantar region, (2 m.) | { Abductor minimi digiti pedis, flexor brevis minimi digiti pedis.                 |
| 5. Intercrosseal region, (7 m.)    | { Interossei externi, et interni.  |

## I. MUSCLES OF THE HEAD.

These are divided into those of the cranium, and those of the face. The first part is divided into two regions, the second into ten.

## I. MUSCLES OF THE CRANIUM.

## 1. EPICRANIAL REGION.

*Occipito-frontalis.*

*Situation.*—At the superior part of the head. *Figure.*—Broad, thin, and quadrilateral. *Attachment.*—Posteriorly to the two external thirds of the superior curved line of the occipital bone, and to the external surface of the mastoid portion of the temporal bone; anteriorly, blended with the corrugator supercilii and orbicularis palpebrarum muscle. *Relations.*—On the outer side with the skin, on the inner with the cranium itself. *Direction.*—A little obliquely from behind forward, and from without inward. *Structure.*—Aponeurotic in its middle portion, where it forms the cranial aponeurosis, fleshy anteriorly and posteriorly. *Use.*—It moves the hairy scalp and the frontal part of the face, and corrugates the skin of the forehead.

## 2. AURICULAR REGION.

*Attollens Auris.*

*Situation.*—On the temple, above the ear. *Figure.*—Triangular. *Attachment.*—Superiorly to the cranial aponeurosis, inferiorly to the cartilage of the ear. *Relations.*—On the outer side with the skin, on the inner with the temporal aponeurosis. *Structure.*—Aponeurotic at its base and summit, fleshy in the rest of its extent. *Use.*—It raises the ear, and tenses the epicranial aponeurosis.

*Attrahens Auris.*

*Situation.*—On the temple, in front of the ear. *Figure.*—Triangular. *Attachment.*—By its base, to the external border of the occipito-frontalis muscle; by its summit, to the anterior part of the helix. *Re-*

*lations*.—On the outer side with the skin, on the inner with the temporal muscle and temporal artery. *Direction*.—Obliquely backward and downward. *Structure*.—Aponeurotic at its base and summit; in other parts fleshy. *Use*.—It draws the ear forward and upward.

*Retrahens Auris.*

*Situation*.—Behind the ear. *Figure*.—Elongated, thin, and flattened. *Attachment*.—Posteriorly to the base of the mastoid process by one or many portions, anteriorly to the postero-inferior part of the convexity of the concha of the ear. *Relations*.—On the outer side with the skin, on the inner with the temporal bone, only separated from it by cellular tissue. *Direction*.—Horizontal. *Structure*.—Fleshy in its middle portion, aponeurotic at its extremities, formed of one or more small fasciculi. *Use*.—It draws the ear backward, and dilates the concha slightly.

## II. MUSCLES OF THE FACE.

### I. PALPEBRAL REGION.

*Orbicularis Palpebrarum.*

*Situation*.—In front of the base of the orbit. *Figure*.—Broad, thin, transversely oval, slit in its great diameter. *Attachment*.—To the ascending process of the superior maxillary bone, and to the internal orbital process of the frontal bone. *Relations*.—In front with the skin; posteriorly with the corrugator supercilii, the broad ligament and fibro-cartilage of the superior eyelid, the malar bone, the muscles of the superior maxillary region, the ligament and fibro-cartilage of the inferior lid, the ascending process of the superior maxillary bone, and the lachrymal sac. *Direction*.—The fibres which surround the base of the orbit form an entire oval; those which are in the lids describe arches of concentric circles. *Structure*.

—Completely fleshy, except at its inner portion, where it forms a small tendon for its insertion. *Use.*—It approximates the eyelids.

*Corrugator Supercilii.*

*Situation.*—In the thickness of the eyebrow. *Figure.*—Thin, narrow, curved from above downward. *Attachment.*—On the inner side to the superciliary ridge; blended on the outside with the occipito-frontalis and orbicularis muscles. *Relations.*—Anteriorly with the orbicularis palpebrarum, the occipito-frontalis and pyramidalis nasi muscles; posteriorly with the frontal bone, and frontal artery and nerve. *Direction.*—Nearly transverse; it ascends a little at first, afterward curves outward. *Structure.*—Completely fleshy, except at its attachment. *Use.*—It produces the expression of frowning, and draws the eyebrows downward.

*Levator Palpebræ Superioris.*

*Situation.*—At the superior part of the orbit. *Figure.*—Elongated, thin, broad in front, narrow behind. *Attachment.*—Posteriorly to the posterior part of the superior wall of the orbit, to the inferior part of the little wing of the sphenoid bone, not far from the optic foramen, and anteriorly to the superior border of the tarsal cartilage of the superior lid. *Relations.*—Superiorly with the orbit and frontal branch of the ophthalmic nerve; anteriorly, separated from the orbicularis palpebrarum by the palpebral ligament, and inferiorly with the rectus superior muscle and the conjunctiva. *Direction.*—Horizontal in its posterior portion, curved from above downward in its anterior. *Structure.*—Fleshy, except at its insertions, which are aponeurotic. *Use.*—It raises the upper lid, and draws it backward to the orbit.

## 2. OCULAR REGION.

*Attollens Oculi, vel Rectus Superior.*

*Situation.*—In the orbit, above the eye. *Figure.*—Thin, broad, curved forward, flattened from above downward. *Attachment.*—Posteriorly to the process of Ingrassias, and to the fibrous sheath of the optic nerve; anteriorly to the superior side of the sclerotica, about two lines from its union with the cornea. *Relations.*—Superiorly with the levator palpebræ superioris; inferiorly with the ophthalmic artery, optic nerve, and nasal branch of the ophthalmic nerve; and anteriorly with the eye itself. *Direction.*—Horizontal. *Structure.*—Aponeurotic at its extremities, fleshy in the rest of its extent. *Use.*—It raises the eye.

*Depressor Oculi, vel Rectus Inferior.*

*Situation.*—In the orbit beneath the eye. *Figure.*—That of the preceding. *Attachment.*—Posteriorly to the body of the sphenoid bone, by a small tendon common to it with the internal and external rectus; anteriorly to the sclerotica. *Relations.*—Inferiorly with the floor of the orbit; superiorly with the optic nerve, with a branch of the third pair, and with the eye. *Direction.*—Horizontal. *Structure.*—Aponeurotic at its attachment, fleshy in the rest of its extent. *Use.*—It depresses the eye.

*Adductor Oculi, vel Rectus Internus.*

*Situation.*—In the orbit, on the inner side of the eye. *Figure.*—Broad, thin, curved forward, flattened from within outward. *Attachment.*—Posteriorly to the body of the sphenoid bone by the above-mentioned tendon, and to a part of the contour of the optic foramen; anteriorly to the internal side of the eye. *Relations.*—On the inner side with the orbit; on the outer with the optic nerve. *Direction.*—Hori-

zontal. *Structure*.—Fleshy, except at its insertions. *Use*.—It brings the eye inward.

*Abductor Oculi, vel Rectus Externus.*

*Situation*.—In the orbit, on the outer side of the eye. *Figure*.—Similar to the preceding. *Attachment*.—Posteriorly like the preceding; anteriorly to the external side of the eye. *Relations*.—On the outer side with the orbit and lachrymal gland; on the inner side with the optic nerves, sixth pair, and lenticular ganglion. *Direction and structure* like the preceding. *Use*. It draws the eye outward.

*Obliquus Superior Oculi.*

*Situation*.—At the internal and superior part of the orbit. *Figure*.—Elongated, flattened posteriorly, rounded anteriorly, and curved at an acute angle towards the middle. *Attachment*.—Posteriorly by short fibres, near the optic foramen, to the prolongation of the dura mater, which covers the orbit, and to the body of the sphenoid bone; anteriorly to the posterior external part of the globe of the eye, near the entrance of the optic nerve. *Relations*.—With the orbit, the optic nerve, the rectus superior and internus muscles, and globe of the eye. *Direction*.—Horizontal as far as the anterior part of the orbit, reflected then outward, backward, and a little downward. *Structure*.—Fleshy in its direct portion, forming in the middle a small rounded tendon, which passes through the pulley formed at the depression in the frontal bone, and becoming tendinous in the rest of its extent. *Use*.—It carries the globe of the eye inward and forward, imparting to it a rotatory motion.

*Obliquus Inferior Oculi.*

*Situation*.—At the antero-inferior part of the orbit. *Figure*.—Elongated, thin, and narrow. *Attachment*.—Anteriorly to the antero-internal part of the orbital

surface of the superior maxillary bone, a little on the outer side of the lachrymal groove; and posteriorly to the postero-external part of the globe of the eye, about two lines distant from the entry of the optic nerve. *Direction*.—Obliquely from within outward, and from before backward. *Structure*.—Aponeurotic at its insertions, fleshy in the rest of its extent. *Use*.—It carries the globe of the eye forward and inward.

### 3. NASAL REGION.

#### *Pyramidalis Nasi.*

*Situation*.—At the antero-superior part of the nose. *Figure*.—Thin, triangular, its summit placed superiorly. *Attachment*.—By its summit to the occipito-frontalis muscle; by its base to the compressor nasi. *Relations*.—Anteriorly with the skin; posteriorly with the corrugator supercilii, frontal bone, and proper bones of the nose. *Direction*.—Vertical. *Structure*.—Aponeurotic in its inferior fourth, fleshy superiorly. *Use*.—It wrinkles the skin of the nose.

#### *Compressor Nasi.*

*Situation*.—On the sides of the nose. *Figure*.—Triangular. *Attachment*.—On the outer side to the internal part of the canine fossa; on the inner side to the dorsum of the nose; one of its portions is fixed to the fibro-cartilage of the wing of the nose. *Direction*.—Transverse. *Structure*.—Aponeurotic anteriorly, fleshy posteriorly. *Use*.—It draws the ala of the nose outward, and dilates the nostril.

#### *Levator Labii Superioris Alæque Nasi.*

*Situation*.—On the sides of the nose, above the upper lip. *Figure*.—Elongated, thin, triangular, narrow superiorly, broader inferiorly. *Attachment*.—Superiorly to the external surface of the ascending process of

the superior maxillary bone ; inferiorly to the wing of the nose and to the upper lip. *Relations*.—Anteriorly with the skin ; posteriorly with the preceding muscle, the ascending process of the superior maxillary bone, the border of the levator labii superioris, the depressor alæ nasi. *Direction*.—Nearly vertical, a little obliquely outward. *Structure*.—Fleshy, except at its superior extremity, which is terminated by short aponeurotic fibres. *Use*.—It raises the ala of the nose and the upper lip, and draws it a little outward.

*Depressor Alæ Nasi.*

*Situation*.—Beneath the wing of the nose, behind the superior lip. *Figure*.—Small, thin, flattened, broader superiorly than inferiorly. *Attachment*.—Inferiorly to the superior maxillary bone, above the alveoles of the incisor teeth ; superiorly to the fibrocartilage of the wing of the nose and to that of the septum. *Direction*.—The internal fibres vertical ; the external obliquely upward and outward. *Use*.—It draws the ala of the nose downward and backward, and slightly depresses the upper lip.

4. SUPERIOR MAXILLARY REGION.

*Levator Labii Superioris.*

*Situation*.—At the middle part of the face. *Figure*.—Thin, flattened, broader superiorly than inferiorly. *Attachment*.—Superiorly to the inferior and internal part of the base of the orbit ; inferiorly blended in the upper lip with the orbicularis oris. *Relations*.—Anteriorly with the orbicularis palpebrarum, labial vein, and skin ; posteriorly with the levator anguli oris (from which it is separated by the sub-orbital vessels and nerves), and with the depressor alæ nasi. *Direction*.—A little oblique from above downward and from without inward. *Structure*.—Fleshy, terminating superiorly by short aponeurotic fibres. *Use*.—It raises the upper lip.



*Levator Anguli Oris.*

*Situation.*—At the middle part of the face. *Figure.*—Flat, thin, broader superiorly than inferiorly. *Attachment.*—Superiorly in the canine fossa, inferiorly to the commissures of the lips. *Relations.*—Anteriorly with the preceding muscle, the sub-orbital vessels and nerves, the zygomaticus minor muscle, and skin; posteriorly with the canine fossa, mucous membrane of the mouth and buccinator muscle. *Direction.*—Oblique from above downward and from within outward. *Structure.*—Completely fleshy. *Use.*—It draws the commissure of the lips upward and inward.

*Zygomaticus Major.*

*Situation.*—At the middle part of the face. *Figure.*—Narrow, thin, and long. *Attachment.*—Superiorly to the external surface of the malar bone, near its posterior angle; inferiorly blended in the commissure of the lips, with the levator anguli oris, depressor anguli oris, buccinator and orbicularis muscles. *Relations.*—Anteriorly with the orbicularis palpebrarum and skin; posteriorly with the malar bone, buccinator and masseter muscles, labial vein, and much adipose tissue. *Direction.*—Oblique from above downward, from without inward, and from behind forward. *Structure.*—Fleshy, except at its superior insertion. *Use.*—It draws the commissure of the lips upward, backward, and outward.

*Zygomaticus Minor.*

*Situation.*—At the middle part of the face, on the inner side of the preceding. *Figure.*—Long, thin, and very narrow. *Attachment.*—Superiorly to the external surface of the malar bone; inferiorly in the superior lip, blended with the levator labii superioris or orbicularis. *Relations.*—Anteriorly with the orbicularis palpebrarum and skin; posteriorly with the

malar bone, the levator anguli oris, and labial vein. *Direction*.—Oblique from above downward and from without inward. *Structure*.—Fleshy. *Use*.—It draws the upper lip upward and outward.

## 5. INFERIOR MAXILLARY REGION.

### *Depressor Anguli Oris.*

*Situation*.—At the inferior part of the face. *Figure*.—Triangular. *Attachment*.—Inferiorly to the external oblique line of the inferior maxilla, from the masseter muscle as far as the submental foramen; superiorly to the commissure of the lips, where the fibres blend with those of the levator anguli oris. *Relations*.—On the outer side with the skin; on the inner side with the platysma myoides, buccinator and depressor labii inferioris muscles. *Direction*.—The middle fibres are vertical, the anterior pass obliquely upward and backward, and the posterior upward and forward. *Structure*.—Fleshy. *Use*.—It depresses the commissure of the lips.

### *Depressor Labii Inferioris.*

*Situation*.—At the inferior part of the face. *Figure*.—Thin and quadrilateral. *Attachment*.—Inferiorly to the external oblique line of the inferior maxilla; superiorly to the inferior lip; blended with the orbicularis oris. *Relations*.—Anteriorly with the preceding muscle and skin; posteriorly with the inferior maxilla, the mental vessels and nerves, the labial muscles, and levator menti. *Direction*.—The fibres pass obliquely upward and inward. *Structure*.—Fleshy. *Use*.—It depresses the lower lip.

### *Levator Menti.*

*Situation*.—At the inferior part of the face, in the chin. *Figure*.—That of a cone, the summit placed upward and a little backward. *Attachment*.—Superiorly to the depression on the side of the symphysis of the chin, beneath the alveoles of the incisor teeth;

inferiorly to the skin of the chin. *Relations*.—Anteriorly with the skin; posteriorly with the mucous membrane of the mouth and inferior maxilla. *Direction*.—Its fibres diverge from above downward. *Structure*.—Fleshy; superiorly forming a small tendon. *Use*.—It raises the chin, and renders it prominent.

## 6. INTERMAXILLARY REGION.

### *Buccinator.*

*Situation*.—In the thickness of the cheeks. *Figure*.—Flat, thin, and quadrilateral. *Attachment*.—Superiorly to the posterior part of the superior alveolar border, from the last tooth as far as the second small molar; inferiorly to the same point of the inferior alveolar border; posteriorly to an aponeurosis, which is common to it with the superior constrictor of the pharynx; anteriorly to the commissure of the lips. *Relations*.—On the outer side with a thick layer of fat, the zygomaticus major, platysma-myoides, depressor anguli oris, with the skin, labial artery, and vein; on the inner side with the mucous membrane of the mouth; opposite the third molar tooth, the parotid duct passes obliquely through it. *Direction*.—The middle fibres horizontal; the superior a little oblique from behind forward, and from above downward; the inferior fibres a little oblique from behind forward, and from below upward. *Structure*.—Fleshy. *Use*.—It draws the commissure of the lips backward, and corrugates the cheek. When it acts with its fellow, it draws the cheeks inward.

### *Orbicularis Oris.*

*Situation*.—In the thickness of the lips. *Figure*.—Composed of two planes of fibres, one for each lip, and each of a semioval form. *Attachment*.—Its extremities, crossing in the commissures of the lips, blend with the various muscles inserted there. *Relations*.—Anteriorly with the skin; posteriorly with

the mucous membrane of the mouth; by its great circumference with the muscles of the three preceding regions. *Direction*.—Horizontal, the two planes of fibres opposite each other. *Structure*.—Fleshy. *Use*.—It closes the mouth, approximating the lips; it is used also in articulating.

## 7. PTERYGO-MAXILLARY REGION.

### *Pterygoideus Internus.*

*Situation*.—At the inner and posterior part of the ramus of the inferior maxillary bone. *Figure*.—A sort of parallelogram, slightly elongated. *Attachment*.—Superiorly to the pterygoid process, and particularly to the internal surface of its external wing; inferiorly to the internal surface of the branch of the inferior maxilla, and to the internal border of its angle. *Relations*.—On the inner side with the circumflexus palati, constrictor pharyngis superior, and submaxillary gland; on the outer side with the branch of the inferior maxilla, from which it is separated superiorly by the lingual nerve, inferior dental artery, and internal lateral ligament of the temporo-maxillary articulation. *Direction*.—A little oblique from above downward, from before backward, and from within outward. *Structure*.—Aponeurotic at its insertions, fleshy in the rest of its extent. *Use*.—The two muscles raise the jaw; one of them also raises it, but carries it at the same time to the opposite side.

### *Pterygoideus Externus.*

*Situation*.—In the zygomatic fossa. *Figure*.—That of a pyramid, with a quadrangular base. *Attachment*.—By one portion to the external face of the pterygoid process, and to the inferior part of the zygomatico-temporal surface of the sphenoid bone; by the other portion to the anterior part of the neck of the condyle of the lower jaw, and to the anterior part of the circumference of the interarticular fibro-cartilage. *Relations*.—On the outer side with the temporal mus-

cle, and frequently with the internal maxillary artery; on the inner side with the inferior maxillary nerve, the pterygoideus internus muscle, and middle meningeal artery; superiorly with the zygomatic fossa, deep temporal and masseteric nerves. *Direction*.—Oblique from before backward, and from within outward. *Structure*.—Fleshy, except at its attachments, which are aponeurotic. *Use*.—It brings the lower jaw forward and inward. The two muscles bring it directly inward.

## 8. TEMPORO-MAXILLARY REGION.

### *Masseter Muscle.*

*Situation*.—At the posterior part of the cheek. *Figure*.—Thick, quadrilateral, slightly elongated. *Attachment*.—Superiorly to the two anterior external thirds of the inferior border of the zygomatic arch, to its internal surface, and at the same time to the internal aponeurosis of the temporal muscle; inferiorly to the angle of the inferior maxilla, to its external surface, and to the inferior border of the ramus of the same. *Relations*.—On the outer side with the parotid gland, platysma myoides, Steno's duct, facial nerve, arteria transversalis faciei, &c.; on the inner side with the ramus of the inferior maxilla, the tendons of the temporalis and buccinator muscles. *Direction*.—A little oblique from above downward, and from before backward. *Structure*.—Composed of aponeurotic and fleshy fibres, which have an oblique insertion. *Use*.—It elevates the lower jaw, and serves essentially for mastication.

### *Temporalis.*

*Situation*.—In the temporal fossa. *Figure*.—Triangular. *Attachment*.—Superiorly in the temporal fossa, and to the semicircular line bounding it; inferiorly to the coronoid process of the inferior maxilla. *Relations*.—On the outer side with the aponeurosis of the cranium, the superior and anterior auricular mus-

cles, the orbicularis palpebrarum and masseter, superficial temporal vessels and nerves, and zygomatic arch; on the inner side with the temporal fossa, the internal maxillary artery, and external pterygoid and buccinator muscles. *Direction*.—All the fibres converge towards the coronoid process. *Structure*.—Composed of two aponeuroses, the one external, covering entirely the muscle; the other internal, placed in the midst of the fleshy fibres, which it divides into two planes, terminating inferiorly by a strong tendon. *Use*.—It elevates the lower jaw, and carries it a little backward.

## 9. LINGUAL REGION.

### *Hyo-glossus.*

*Situation*.—At the superior and anterior part of the neck. *Figure*.—Thin, flat, quadrilateral. *Attachment*.—Inferiorly to the body and great horn of the os hyoides; superiorly to the inferior lateral part of the tongue. *Relations*.—On the outer side with the stylo-glossus, mylo-hyoideus, hypo-glossal nerve, sub-maxillary gland, genio-hyoideus, stylo-hyoideus, and digastricus; on the inner side with the constrictor medius pharyngis, genio-glossus, lingual artery, and glosso-pharyngeal nerve. *Direction*.—Nearly vertical. *Structure*.—Fleshy. *Use*.—It carries the tongue backward and downward, and raises the hyoid bone.

### *Genio-glossus.*

*Situation*.—At the supero-anterior part of the neck, behind the inferior maxilla. *Figure*.—Flattened transversely, triangular. *Attachment*.—Anteriorly to the sub-mental process, posteriorly to the whole inferior surface of the tongue, and to the summit of the small cornu of the os hyoides. *Relations*.—On the outer side with the sub-lingual gland, stylo-glossus, hyo-glossus, lingualis, and mylo-hyoideus muscles; on the inner side with that of the opposite region.

*Direction.*—Its fibres diverge from the mental process towards the inferior surface of the tongue and os hyoides. *Structure.*—Fleshy. *Use.*—It can carry the tongue forward or backward, as the position of its fibres are so varied.

### *Stylo-glossus.*

*Situation.*—At the upper and anterior part of the neck. *Figure.*—Narrow posteriorly, broad and thin anteriorly. *Attachment.*—Posteriorly to the styloid process and to the stylo-maxillary ligament; anteriorly to the side of the tongue. *Relations.*—On the outer side with the digastricus muscle, lingual nerve, sub-maxillary gland, and mucous membrane of the mouth; on the inner side with the constrictor pharyngis superior, hyo-glossus, and lingualis. *Direction.*—Oblique from behind forward, from above downward, and from without inward. *Structure.*—Fleshy, except at its posterior extremity. *Use.*—It elevates the tongue, and carries it backward and to the side.

### *Lingualis.*

*Situation.*—At the inferior and lateral part of the tongue. *Figure.*—Elongated, broader anteriorly than posteriorly. *Attachment.*—Blended by its extremities and one part of its circumference with the other muscles of the tongue. *Relations.*—Inferiorly with the mucous membrane of the mouth; superiorly with the fleshy tissue of the tongue. *Direction.*—Horizontal. *Structure.*—Fleshy. *Use.*—It shortens the tongue, and depresses its tip.

## 10. PALATINE REGION.

### *Circumflexus Palati.*

*Situation.*—Along the internal wing of the pterygoid process, and in the thickness of the velum palati. *Figure.*—Thin, elongated, flattened transversely. *Attachment.*—Superiorly to the base of the internal

wing of the pterygoid process, to the neighbouring part of the great wing of the sphenoid bone, and to the antero-external part of the fibro-cartilage of the Eustachian tube; inferiorly to the transverse crest on the inferior surface of the horizontal portion of the palatine bone, and to the velum palati. *Relations*.—On the outer side with the pterygoideus-internus; on the inner side with the levator palati, constrictor pharyngis superior, and with the internal wing of the pterygoid process. *Direction*.—Vertical in its superior portion, nearly horizontal in the inferior. *Structure*.—Aponeurotic inferiorly, fleshy superiorly. *Use*.—It tenses horizontally the velum palati, drawing it outward, and it can dilate the Eustachian tube.

#### *Levator Palati Mollis.*

*Situation*.—In the velum palati. *Figure*.—Elongated, narrow, rounded superiorly, broad and flat inferiorly. *Attachment*.—Superiorly to the inferior surface of the petrous portion of the temporal bone, in front of the external orifice of the carotid canal, and to the fibro-cartilage of the Eustachian tube; inferiorly to the middle part of the velum palati. *Relations*.—On the outer side with the circumflexus palati, palato-pharyngeus, and constrictor pharyngis superior; on the inner side with the mucous membrane of the pharynx and that of the velum palati. *Direction*.—Oblique from above downward, from before backward, and from without inward. *Structure*.—Fleshy, except superiorly. *Use*.—It raises the velum palati, and carries it backward.

#### *Musculus Uvulae.*

*Situation*.—In the middle of the velum palati. *Figure*.—Fusiform, elongated. *Attachment*.—Superiorly to the guttural spine, and to the aponeurosis common to the two preceding muscles; inferiorly to the summit of the uvula. *Direction*.—Vertical. *Structure*.—Fleshy. *Use*.—It shortens and raises the uvula and velum palati.



*Palato-pharyngeus.*

*Situation.*—In the thickness of the pharynx and in that of the velum palati, forming its posterior pillar. *Figure.*—Long, thin, flattened from before backward in the velum palati, and transversely in the pharynx; narrow in the portion which forms the posterior pillar. *Attachment.*—Superiorly to the posterior border of the palatine arch, and to the aponeurosis of the circumflexus palati; inferiorly to the thyroid cartilage, and to the thickness of the pharynx. *Relations.*—Posteriorly with the mucous membrane of the velum palati, levator palati, and constrictores pharyngis; anteriorly with the aponeurosis of the circumflexus palati and mucous membrane of the pharynx. *Direction.*—A little obliquely downward, backward, and outward. *Structure.*—Fleshy. *Use.*—It depresses the velum palati, and raises the palate.

*Constrictor Isthmi Faucium.*

*Situation.*—In the thickness of the anterior pillar of the velum palati, in front of the amygdalæ. *Figure.*—Elongated, thin, and narrow. *Attachment.*—Inferiorly to the lateral part of the base of the tongue, superiorly to the velum palati. *Direction.*—A little oblique from below upward, from before backward, and from without inward. *Structure.*—Fleshy. *Use.*—It depresses the velum palati, and elevates the base of the tongue.

## I. MUSCLES OF THE TRUNK.

These are divided into those of the neck, thorax, abdomen, and posterior part of the trunk.

## 1. MUSCLES OF THE NECK.

They are distributed into six regions.

## 1st. SUPERFICIAL CERVICAL REGION.

*Platysma Myoides.*

*Situation.*—At the anterior and lateral part of the neck, from the superior part of the thorax to the inferior part of the face. *Figure.*—Broad, thin, and quadrilateral. *Attachment.*—Inferiorly to the cellular tissue which covers the pectoralis major and deltoid muscles; superiorly to the inferior part of the symphysis of the chin, to the external oblique line of the inferior maxilla, and to the commissure of the lips. *Relations.*—On the outer side with the skin; on the inner side with the deltoideus, pectoralis major, and sterno-mastoideus muscles, and with the clavicle, with the muscles of the hyoidean, maxillary, and intermaxillary regions, external jugular vein, submaxillary gland, body of the inferior maxilla, and a part of the parotid gland. *Direction.*—Oblique from below upward, and from without inward. *Structure.*—Fleshy. *Use.*—It corrugates the skin of the neck, and draws the mouth downward and outward.

*Sterno-cleido-mastoideus.*

*Situation.*—At the anterior and lateral part of the neck. *Figure.*—Long, flat, divided inferiorly into two portions. *Attachment.*—Inferiorly to the anterior and superior part of the sternum, and to the internal fourth of the posterior edge and superior surface of the clavicle; superiorly to the summit of the mastoid process of the temporal bone, and to the external third of the superior curved line of the occipital bone. *Relations.*—On the outer side with the platysma myoides, parotid gland, and skin; between it and the platysma myoides, the external jugular vein, and some nervous filaments of the superficial cervical plexus; on the inner side with the articulation of the sternum and clavicle, sterno-thyroideus, sterno-hyoideus, and omo-hyoideus muscles, internal jugular vein, carotid artery, pneumogastric nerve, cervical plexus,

great sympathetic nerve and *scaleni angularis*, *splenius*, and *digastricus*. *Direction*.—Oblique from below upward, from before backward, and from within outward. *Structure*.—Tendinous and aponeurotic at its insertions, fleshy in other parts. *Use*.—It draws the head towards its side, and at the same time imparts to it a rotatory motion, which turns the face from the opposite side. When both muscles act together, the head is brought forward.

## 2d. SUPERIOR HYOIDEAN REGION.

### *Digastricus.*

*Situation*.—At the superior, anterior, and lateral part of the neck. *Figure*.—Rounded, small in the middle, thick at its extremities, and slightly curved. *Attachment*.—Posteriorly to the mastoid groove of the temporal bone; traversing or passing behind the inferior part of the *stylo-hyoid* muscle, and passing through the aponeurotic ring formed on the superior border of the *os hyoides*; anteriorly to the depression on the sides of the symphysis of the chin; inferiorly, by its tendinous middle portion, to the anterior surface of the body of the *os hyoides*. *Relations*.—On the outer side with the *complexus minor*, *splenius*, and *sternomastoides* muscles, *sub-maxillary* gland, and *platysma myoides*; on the inner side with the *stylo-hyoides*, *stylo-glossus*, and *stylo-pharyngeus* muscles, the external and internal carotids, internal jugular vein, *hypo-glossal* nerve, and *hyo-glossus* and *mylo-hyoideus* muscles. *Direction*.—Oblique from behind forward, from above downward, and from without inward, from the *digastric* groove, as far as the *os hyoides*; and from this bone as far as the inferior maxilla, obliquely upward, forward, and inward. *Structure*.—Tendinous at its middle, fleshy at the extremities. *Use*.—It brings the lower jaw downward and backward. If this be fixed, it raises the hyoid bone and brings it forward.

*Stylo-hyoideus.*

*Situation.*—At the superior, anterior, and lateral part of the neck. *Figure.*—Elongated, thin, and narrow. *Attachment.*—Superiorly to the styloid process of the temporal bone, near its base; inferiorly to the side of the body of the os hyoides. *Relations.*—On the outer side with the digastricus, on the inner with the external carotid, labial, and lingual arteries, internal jugular vein, stylo-glossus, stylo-pharyngeus, and hyo-glossus muscles, and hypo-glossal nerve. *Direction.*—Obliquely from above downward, from behind forward, and from without inward. *Structure.*—Tendinous at its insertions, fleshy in other parts. *Use.*—It raises the hyoid bone, and carries it backward and to the side.

*Mylo-hyoideus.*

*Situation.*—At the anterior and superior part of the neck. *Figure.*—Broad, thin, triangular. *Attachment.*—Superiorly to nearly the whole extent of the internal oblique line of the inferior maxilla; inferiorly to the middle part of the anterior surface of the body of the os hyoides; on the inner side to a short aponeurosis common to it with the muscle of the opposite side. *Relations.*—On the outer side with the digastricus, platysma myoides, and sub-maxillary gland; on the inner side with the genio-hyoideus, genio-glossus, hyo-glossus, sub-lingual gland, duct of the sub-maxillary gland, prolongation of this gland, and the lingual nerve. *Direction.*—Obliquely from above downward, from without inward, and from before backward. *Structure.*—Aponeurotic at its insertions, fleshy in the rest of its course. *Use.*—It carries the hyoid bone upward and forward, or, if this bone be fixed, it depresses the lower jaw.

*Genio-hyoideus.*

*Situation.*—At the anterior and superior part of the neck. *Figure.*—Elongated, thin, narrower superiorly

than inferiorly. *Attachment*.—Superiorly to the inferior part of the mental process; inferiorly to the middle part of the anterior face of the body of the os hyoides. *Relations*.—Anteriorly with the mylo-hyoideus; posteriorly with the genio-glossus and hyoglossus. *Direction*.—Oblique from above downward and from before backward. *Structure*.—Fleshy, except at its superior insertion. *Use*.—It brings the hyoid bone upward and forward, or depresses the jaw.

### 3d. INFERIOR HYOIDEAN REGION.

#### *Omo-hyoideus.*

*Situation*.—At the anterior and lateral part of the neck. *Figure*.—Long, thin, and very narrow. *Attachment*.—Posteriorly to the superior edge of the scapula, behind the notch observed there, sometimes to the ligament of this notch, at other times to the base of the coronoid process; anteriorly and superiorly to the side of the inferior border of the body of the os hyoides. *Relations*.—On the outer side with the trapezius, platysma myoides, and sterno mastoideus muscles; on the inner side with the sealeni muscles, the anterior branches of the inferior cervical nerves, the primitive carotid, the internal jugular vein, the superior thyroidean vessels, sterno-hyoideus and sterno-thyroideus muscles. *Direction*.—Obliquely from below upward, from without inward, and from behind forward. *Structure*.—Tendinous at its middle, fleshy at its extremities. *Use*.—It brings the hyoid bone downward, a little backward, and to the side.

#### *Sterno-hyoideus.*

*Situation*.—At the anterior part of the neck. *Figure*.—Thin, long, narrow. *Attachment*.—Inferiorly to the superior part of the posterior surface of the sternum, to the capsule of the articulation of this bone with the clavicle, and sometimes to the cartilage of the first rib; superiorly to the inferior border of the

body of the os hyoides. *Relations*.—Anteriorly with the clavicle, sterno-mastoideus, platysma myoides, omo-hyoideus, and skin; posteriorly with the sterno-thyroideus, crico-thyroideus, thyro-hyoideus, thyro-hyoidcan membrane, thyroid gland, and superior thyroidean vessels. *Direction*.—A little oblique from below upward and from without inward. *Structure*.—Aponeurotic at its insertions, presenting generally near its middle an aponeurotic insertion. *Use*.—It depresses the hyoid bone.

### *Sterno-thyroideus.*

*Situation*.—At the anterior part of the neck. *Figure*.—Thin, long, and narrow. *Attachment*.—Inferiorly to the superior part of the posterior surface of the sternum, on a level with the cartilage of the second rib; superiorly to the oblique line on the external surface of the thyroid cartilage. *Relations*.—Anteriorly with the sterno-hyoideus, sterno-mastoideus, and omo-hyoideus; posteriorly with the subclavian veins, internal jugular, primitive carotid artery, trachea, thyroid gland, crico-thyroid muscle, and a part of the constrictor pharyngis inferior. *Direction*.—A little oblique from below upward, and from within outward. *Structure*.—Aponeurotic at its insertions, presenting sometimes inferiorly an intersection of the same nature. *Use*.—It brings the thyroid cartilage downward.

### *Thyro-hyoideus.*

*Situation*.—At the anterior and superior part of the neck. *Figure*.—Thin, quadrilateral, a little elongated. *Attachment*.—Inferiorly to the external oblique line on the anterior surface of the thyroid cartilage; superiorly to the inferior edge of the body of the os hyoides, and to the anterior half of the external border of its great cornu. *Relations*.—Anteriorly with the sterno-hyoideus, omo-hyoideus, and platysma myoides; posteriorly with the thyroid cartilage and thyro-hyoidcan membrane. *Direction*.—Vertical. *Struc-*

*ture.*—Fleshy. *Use.*—It depresses the os hyoides, and brings the thyroid cartilage upward.

#### 4th. PHARYNGEAL REGION.

##### *Constrictor Pharyngis Inferior.*

*Situation.*—At the inferior part of the pharynx. *Figure.*—Thin, broad, and quadrilateral. *Attachment.*—Anteriorly to the external face of the cricoid cartilage, to the lesser cornu, and oblique line of the thyroid cartilage; posteriorly to the middle and infero-posterior part of the pharynx, where it blends with that of the opposite side. *Relations.*—1st, By its exterior surface, on the outer side, with the sterno-thyroideus, thyroid gland, and primitive carotid artery; posteriorly with the rectus capitis anticus major and longus colli muscles, and anterior vertebral ligament; 2d, By its interior face with the constrictor medius, palato-pharyngeus, stylo-pharyngeus, mucous membrane of the pharynx, and thyroid and cricoid cartilages. *Direction.*—Obliquely from below upward, and from before backward. *Structure.*—Fleshy. *Use.*—It contracts the pharynx as the food passes down.

##### *Constrictor Pharyngis Medius.*

*Situation.*—At the middle part of the pharynx. *Figure.*—Triangular. *Attachment.*—Anteriorly to the superior face of the great cornu of the os hyoides, to the inferior part of the lesser cornu, and to the stylo-hyoidean ligament; posteriorly to the middle posterior part of the pharynx by a raphe, the superior extremity of which is fixed to the basilar process of the occipital bone. *Relations.*—1st, By its exterior surface with the hyo-glossus, the lingual artery on the outside, and inferior constrictor below; in the rest of its extent with the muscles of the deep cervical region and anterior vertebral ligament; 2d, By its internal surface with the mucous membrane of the pharynx, stylo-pharyngeus, palato-pharyngeus, and superior constrictor muscles. *Direction.*—Middle fibres hori-

zontal; superior, oblique from before backward and from below upward; and the inferior, oblique from before backward and from above downward. *Structure*.—Fleshy. *Use*.—Same as preceding.

### *Constrictor Pharyngis Superior.*

*Situation*.—At the superior part of the pharynx. *Figure*.—Broad, thin, and quadrilateral. *Attachment*.—Anteriorly to the inferior half of the posterior edge of the internal wing of the pterygoid process, to an aponeurosis common to it with the buccinator muscle, to the posterior extremity of the internal oblique line of the inferior maxilla, to the side of the base of the tongue; posteriorly to the middle and superior part of the pharynx, where it blends with that of the opposite side; and superiorly to the inferior surface of the basilar process of the occipital bone. *Relations*.—1st, By its *exterior* surface with the preceding, with the stylo-glossus, stylo-pharyngeus, internal carotid artery, internal jugular vein, pneumogastric, hypo-glossal, and spinal nerves; 2d, By its *interior* surface with the palato-pharyngeus, levator palati, and mucous membrane of the pharynx. *Direction*.—The fibres are horizontal, except the superior, which are a little oblique from below upward, and curved. *Structure*.—Fleshy, except at its anterior insertions, which are aponeurotic, as also at its attachment to the occipital bone, which presents an aponeurosis termed the cephalo-pharyngeal aponeurosis. *Use*.—Same as preceding.

### *Stylo-pharyngeus.*

*Situation*.—At the posterior and lateral part of the pharynx. *Figure*.—Rounded, small superiorly, broad and flattened inferiorly. *Attachment*.—Superiorly to the internal part of the styloid process of the temporal bone; inferiorly to the pharynx, where it is confounded with the preceding muscles, and to the posterior border of the thyroid cartilage. *Relations*.—On the outer side with the stylo-hyoideus, constrictor



medius, and external carotid artery; on the inner side with the internal carotid artery, internal jugular vein, mucous membrane of the pharynx, superior constrictor and palato-pharyngeus muscles. *Direction*.—Obliquely from above downward, from without inward, and from before backward. *Structure*.—Fleshy. *Use*.—It raises the pharynx.

#### 5th. DEEP CERVICAL REGION.

##### *Rectus Capitis Anticus Major.*

*Situation*.—At the supero-anterior lateral part of the vertebral column. *Figure*.—Long, flat, broader superiorly than inferiorly. *Attachment*.—Inferiorly to the anterior tubercle of the transverse processes of the 6th, 5th, 4th, and 3d cervical vertebræ, by as many small tendons; superiorly to the inferior surface of the basilar process of the occipital bone. *Relations*.—Anteriorly with the carotid artery, internal jugular vein, pneumogastric nerve, superior cervical ganglion, and pharynx; posteriorly with the longus colli, the articulations of the atlas with the occiput, and of the axis with the atlas, and with the transverse cervical processes. *Direction*.—A little obliquely from below upward and from without inward. *Structure*.—Tendinous at its inferior extremities, aponeurotic at its superior attachment, fleshy in the rest of its extent. *Use*.—It flexes the head on the vertebral column.

##### *Rectus Capitis Anticus Minor.*

*Situation*.—At the superior and anterior part of the vertebral column, behind the preceding. *Figure*.—Long, narrow, and thin. *Attachment*.—Superiorly in front of the lateral mass and transverse process of the atlas; anteriorly to the inferior surface of the basilar process of the occipital bone. *Relations*.—Anteriorly with the preceding muscle, posteriorly with the articulation of the atlas and occiput. *Direction*.—A little obliquely from below upward and from without inward. *Structure*.—Aponeurotic at its extremities,

fleshy in the rest of its extent. *Use*.—It inclines the head forward and a little to the side.

### *Longus Colli.*

*Situation*.—At the anterior and superior part of the vertebral column, from the atlas as far as the third dorsal vertebra. *Figure*.—Elongated, flat, broader in its middle portion than at its extremities. *Attachment*.—Inferiorly to the anterior surface of the bodies of the first three dorsal and last four cervical vertebræ, to the intervertebral fibro-cartilages, and to the anterior edge of the transverse processes of the third, fourth, and fifth cervical vertebræ; superiorly to the tubercle on the anterior arch of the atlas. *Relations*.—Anteriorly with the rectus capitis anticus major, pharynx, carotid artery, pneumogastric and great sympathetic nerves, and with the œsophagus; posteriorly with the vertebræ, to which it is attached, and with their fibro-cartilages; on a level with the first two dorsal vertebræ, its external border is separated from the scalenus anticus by a triangular space lodging the vertebral artery and vein. *Direction*.—A little obliquely from below upward and from without inward. *Structure*.—Tendinous at its insertions, aponeurotic at its anterior surface, fleshy in the rest of its extent. *Use*.—It flexes the neck when it acts with its fellow: one muscle draws it a little to its side.

## 6th. LATERAL CERVICAL REGION.

### *Scalenus Anticus.*

*Situation*.—At the inferior and lateral part of the neck. *Figure*.—Elongated, flat, simple below, divided into many portions above. *Attachment*.—Inferiorly to the centre of the internal surface and of the superior face of the first rib; superiorly to the anterior tubercle of the transverse processes of the 3d, 4th, 5th, and 6th cervical vertebræ. *Relations*.—Anteriorly with the subclavian vein, transverse and as-

ending cervical arteries, diaphragmatic nerve, omohyoideus, sterno-hyoideus; posteriorly, it forms with the following muscle a triangular space, lodging inferiorly the subclavian artery, and superiorly the branches of the cervical nerves forming the brachial plexus; on the inner side with the vertebral artery and vein which separate it from the longus colli muscle. *Direction*.—A little oblique from below upward, from without inward, and from before backward. *Structure*.—Tendinous at its insertions. *Use*.—It flexes the neck laterally, and raises the first rib.

### *Scalenus Posticus.*

*Situation*.—At the lateral part of the neck, behind the preceding. *Figure*.—Long, flat, slightly triangular. *Attachment*.—Inferiorly to the upper face of the first rib, to a rough depression behind the passage of the subclavian artery, and to the superior border of the second rib; superiorly to the posterior tubercle of the transverse processes of the last six cervical vertebræ by six small tendons. *Relations*.—Anteriorly with the preceding, from which it is separated by the subclavian artery and anterior branches of the cervical nerves; posteriorly with the transversus cervicis, splenius, and levator anguli scapulæ muscles; on the inner side with the first intercostal and summit of the six last transverse cervical processes. *Direction*.—A little oblique from below upward, from without inward, and from behind forward. *Structure*.—Tendinous at its insertions, fleshy in other parts. *Use*.—It inclines the head and the neck to its side, and raises the first two ribs.

### *Rectus Capitis Lateralis.*

*Situation*.—At the superior lateral part of the vertebral column. *Figure*.—Thin, flat. *Attachment*.—Inferiorly to the anterior part of the transverse process of the atlas; superiorly to the inferior surface of the jugular process of the occipital bone. *Relations*.—Anteriorly with the internal jugular vein, pos-

teriorly with the vertebral artery. *Direction*.—Vertical. *Structure*.—Aponeurotic at its attachments, fleshy in other parts. *Use*.—It inclines the head to its side and a little forward.

## II. MUSCLES OF THE CHEST.

The chest has four muscular regions.

### I. ANTERIOR THORACIC REGION.

#### *Pectoralis Major.*

*Situation*.—At the anterior part of the chest, in front of the axilla. *Figure*.—Broad, flattened from before backward, triangular. *Attachment*.—On the inner side, by its base, to the internal half of the anterior edge of the clavicle, to the middle part of the anterior face of the sternum, to the cartilage of the true ribs, except the first, and particularly to the sixth, a little to the osseous portion of the fifth rib, and to an aponeurosis common to it with the abdominal muscles; on the outer side by its summit to the anterior edge of the bicipital groove. *Relations*.—Anteriorly with the platysma myoides, mammary gland and skin; posteriorly with a portion of the anterior face of the sternum, the cartilages of the true ribs, a part of their osseous portion, the thoracic vessels and nerves, the subclavius, pectoralis minor, external intercostal, serratus magnus, rectus, and obliquus abdominis muscles; and in the axilla, with much cellular tissue, the axillary ganglia, the axillary vessels and nerves of the brachial plexus. *Direction*.—The superior fibres, oblique from within outward and from above downward; the middle fibres, horizontal; the inferior, oblique from below upward and from within outward. *Structure*.—Aponeurotic at its internal insertions, tendinous at its external attachment, fleshy in other parts. *Use*.—It brings the arm towards the chest, and carries it a little forward. It may contribute to respiration by raising the ribs and dilating the chest.

*Pectoralis Minor.*

*Situation.*—At the anterior and superior part of the chest. *Figure.*—Flat and triangular. *Attachment.*—On the inner side to the superior edge and external face of the third, fourth, and fifth true ribs; on the outer side to the anterior part of the internal edge of the coracoid process. *Relations.*—Anteriorly with the pectoralis major muscle; posteriorly with the ribs, external intercostal and serratus magnus muscles, axillary vessels, and brachial plexus. *Direction.*—Obliquely from below upward, from before backward, and from within outward. *Structure.*—Aponeurotic at its attachment to the ribs, tendinous at its external extremity, fleshy in the rest of its extent. *Use.*—It draws the coracoid process forward, downward, and inward; if the shoulder is fixed, it raises the ribs.

*Subclavius.*

*Situation.*—At the superior and anterior part of the chest. *Figure.*—Elongated, flattened from before backward, thicker in the centre than at the extremities. *Attachment.*—By its internal extremity, to the superior face of the cartilage of the first rib; by its superior edge and external extremity, to the external part of the inferior surface of the clavicle. *Relations.*—Anteriorly with the pectoralis major; between them we observe a thin aponeurosis, extending from the clavicle and coracoid process towards the first ribs; posteriorly with the axillary vessels and brachial plexus; inferiorly separated from the first rib by the above vessels; superiorly with the clavicle. *Direction.*—A little oblique from within outward, from above downward, and from before backward. *Structure.*—Tendinous at its internal insertion, aponeurotic at the external, fleshy in other parts. *Use.*—It depresses the clavicle; it may also raise the first rib.

## 2. LATERAL THORACIC REGION.

*Serratus Magnus.*

*Situation.*—On the lateral parts of the thorax. *Figure.*—Broad, thin, and flattened; broader anteriorly than posteriorly. *Attachment.*—Anteriorly to the external face of the eight or nine first ribs by as many digitations; posteriorly by separate portions to the internal border, and superior and inferior angles of the scapula. *Relations.*—On the outer side with the two pectoral muscles, latissimus dorsi, sub-scapularis, axillary vessels, and brachial plexus; on the inner side with the seven or eight first ribs, corresponding intercostal muscles, and a portion of the serratus posticus superior. *Direction.*—The superior fibres are nearly horizontal, the others are oblique from before backward and from below upward. *Structure.*—Aponeurotic at its insertions, fleshy in the rest of its extent. *Use.*—It draws the scapula and the upper limb forward and inward, and it can carry outward and backward the ribs to which its digitations are attached.

## 3. INTERCOSTAL REGION.

*Intercostales Externi.*

*Number.*—Eleven on each side. *Situation.*—In the intercostal spaces, from the articulation of the ribs with the transverse processes of the vertebræ as far as the costal cartilages. *Figure.*—Thin, flattened from within outward. *Attachment.*—By one part to the external lip of the superior edge of the rib beneath; by the other to the external lip of the inferior edge of the rib above. *Relations.*—On the outer side with the pectoral muscles, serratus magnus, obliquus externus abdominis, serratus posticus superior and inferior, sacro-lumbalis, and longissimus dorsi; on the inner side with the pleura, from the tuberosity as far as the angle of the rib; in the rest of the intercostal space with the internal intercostal muscles.

*Direction*.—The fibres are oblique from above downward, and from behind forward. *Structure*.—Entirely fleshy, except at the insertions. *Uses*.—The intercostales muscles serve to approximate the ribs, and, consequently, to contract the chest, if they act simultaneously while the twelfth rib is fixed. When the external intercostales act alone, they raise the ribs and become inspiratory.

*Intercostales Interni.*

*Number*.—Eleven on each side. *Situation*.—Between the ribs, from their angle as far as the edge of the sternum. *Figure*.—Similar to those preceding. *Attachment*.—To the internal lip of the inferior edge of the rib above, and to the internal lip of the superior edge of the rib beneath. *Relations*.—On the outer side with the preceding muscles, and intercostal vessels and nerves; on the inner side with the pleura. *Direction*.—The fibres are oblique from above downward and from before backward. *Structure*.—Entirely fleshy, except at the insertions. *Use*.—The internal intercostals seem designed to depress the ribs if the twelfth is kept stationary by the quadratus lumborum. If the last muscle be relaxed, the internal intercostals may contribute with the external to elevate the ribs.

*Levatores Costarum Breviores et Longiores.*

*Number*.—Twelve on each side. *Situation*.—Posteriorly on the costo-vertebral articulations. *Figure*.—Very small, flat, thin, and triangular. *Attachment*.—By one part to the summit of the transverse process of the vertebra which is above; by the other part to the upper edge of the rib which is beneath. *Direction*.—Oblique from above downward, from within outward, and from behind forward. *Structure*.—Fleshy, except at the attachments. *Use*.—They elevate the ribs.

*Triangularis Sterni.*

*Situation.*—At the anterior and inferior part of the chest, behind the cartilage of the ribs. *Figure.*—That of a triangle, the base below. *Attachment.*—On the inner side to the postero-lateral inferior part of the sternum, and to the edge of the xiphoid cartilage; on the outer side to the cartilages of the third, fourth, fifth, and sixth ribs. *Relations.*—Anteriorly with the cartilages of the four last true ribs, internal intercostal muscles, internal mammary vessels; posteriorly with the pleura, and a little with the diaphragm. *Direction.*—Inferior fibres transverse; the rest more oblique from below upward and from within outward, as they are more superior. *Structure.*—Aponeurotic at its attachments. *Use.*—It carries the cartilages to which it is attached backward, inward, and downward.

## 4. DIAPHRAGMATIC REGION.

*Diaphragma.*

*Situation.*—Transversely between the pectoral and abdominal cavities, which it separates. *Figure.*—Broad, nearly circular anteriorly, flattened from above downward, convex superiorly, elongated and terminating in a point posteriorly. *Attachment.*—Anteriorly to the xiphoid cartilage; laterally to the internal surface of the cartilages of the last six ribs; posteriorly to the transverse process of the first lumbar vertebra; by its left pillar to the body of the first three lumbar vertebræ; by its right to the body of the first four. *Relations.*—Superiorly and in the middle with the pericardium and mediastina; superiorly and laterally with the ribs, the pleuræ, the base of the lungs, and lateral parts of the thorax; posteriorly with the aorta, psoas, and quadratus lumborum muscles; infero-posteriorly with the kidneys, surrenal capsules, pancreas, and duodenum; inferiorly and on the right with the liver; inferiorly and on the left with the stomach and



spleen. *Direction*.—The posterior fibres are nearly vertical; all the others converge towards the centre of the muscle. *Structure*.—Formed in the middle of a three-lobed aponeurosis, termed the *phrenic centre*, pierced with an opening for the inferior vena cava; fleshy in the rest of its extent, and presenting posteriorly two openings, one for the œsophagus and par vagum, the other traversed by the aorta, vena azygos, and thoracic canal. *Use*.—It separates the chest from the belly, serves for respiration by dilating the chest, and contributes to the evacuation of the feces and urine.

### III. MUSCLES OF THE ABDOMEN.

The abdomen embraces four muscular regions.

#### 1. ABDOMINAL REGION.

##### *Obliquus Abdominis Externus.*

*Situation*.—On the anterior and lateral parts of the abdomen. *Figure*.—Broad, thin, and quadrilateral. *Attachment*.—Superiorly to the external face and inferior edge of the seven or eight last ribs, by as many digitations; inferiorly to the two anterior thirds of the external border of the crista ilii; anteriorly to the linea alba. *Relations*.—On the outer side with the skin; often posteriorly with the latissimus dorsi; on the inner side with the anterior part of the seven or eight last ribs and their cartilages, the corresponding intercostal muscles, the obliquus internus, and rectus abdominis muscles. *Direction*.—The superior fibres are nearly horizontal; the middle are oblique from above downward and from behind forward; the inferior and posterior are nearly vertical. *Structure*.—Fleshy posteriorly, composed anteriorly of a broad aponeurosis termed the abdominal aponeurosis, more extensive inferiorly than superiorly, contracted at the middle, which, in uniting on the median line with that of the opposite side, forms a tendinous cord termed

the *linea alba*, presenting, 1st, Inferiorly, a strong resistant fold, termed Poupart's ligament, fixed by one portion to the antero-superior iliac spine, and by the other to the pubis; 2d, On the infero-lateral side, two whitish bands, termed the pillars of the inguinal ring, between which is the opening of the same name. *Use*.—It approximates the chest and pelvis, by contracting the cavity of the abdomen.

*Obliquus Abdominis Internus.*

*Situation*.—On the anterior and lateral parts of the abdomen. *Figure*.—Thin, broad, and quadrilateral; much broader anteriorly than posteriorly. *Attachment*.—Superiorly to the inferior border of the cartilages of the fifth, fourth, third, and second false ribs; inferiorly to the three anterior fourths of the interstice on the iliac spine, to the posterior part of the crural arch and pubis; posteriorly to the spinous processes of the last two lumbar vertebræ, and to the first two tubercles of the sacrum; anteriorly to the *linea alba*. *Relations*.—On the outer side with the former muscle and the latissimus dorsi muscle; on the inner side with the transversalis abdominis and sacro-lumbalis. *Direction*.—The superior fibres are oblique from below upward and from behind forward; the middle, horizontal; the inferior, a little oblique from above downward and from without inward. *Structure*.—Aponeurotic anteriorly and posteriorly. *Use*.—Same as that of preceding.

*Transversalis Abdominis.*

*Situation*.—On the lateral and anterior parts of the abdomen. *Figure*.—Broad, flat, quadrilateral; broader anteriorly than posteriorly. *Attachment*.—Superiorly to the internal face of the cartilages of the sixth, seventh, eighth, ninth, and tenth false ribs, to that of the last true rib, and to the inferior edge of the last false rib; inferiorly to the three anterior fourths of the internal edge of the crest of the ilium, to the two external thirds of the crural arch; posteriorly to the

summit of the transverse and spinous processes of the first four lumbar vertebræ; anteriorly to the linea alba, and to the border of the xiphoid cartilage. *Relations*.—On the inner side with the peritoneum, on the outer side with the preceding muscle. *Direction*.—Transverse. *Structure*.—Aponeurotic at its anterior and posterior extremities, fleshy in the centre. *Use*.—It contracts the abdominal cavity, and carries inward the ribs to which it is inserted.

### *Rectus Abdominis.*

*Situation*.—At the middle and anterior part of the abdomen. *Figure*.—Long, flattened from before backward, broader superiorly than inferiorly. *Attachment*.—Superiorly to the cartilages of the last three true ribs, and to the costo-xiphoid ligament; inferiorly to the symphysis pubis. *Relations*.—Anteriorly with the aponeurosis of the pectoralis major, that of the abdomen, and the pyramidalis muscle; posteriorly with the cartilages of the last three true ribs, a portion of the cartilages of the first two false ribs, the xiphoid cartilage, the posterior fold of the abdominal aponeurosis, the internal mammary and epigastric arteries, and peritoneum. *Direction*.—Vertical. *Structure*.—Tendinous at its attachments, fleshy in the rest of its extent; divided by three, four, or five aponeurotic intersections, placed transversely. *Use*.—It contracts the cavity of the abdomen, and flexes the chest on the pelvis, and the pelvis on the chest.

### *Pyramidalis.*

*Situation*.—At the inferior and middle part of the abdomen. *Figure*.—Triangular. *Attachment*.—Superiorly to the antero-superior part of the symphysis pubis, and a little to the bone; superiorly to the linea alba, three or four inches above the pubis. *Relations*.—Anteriorly with the abdominal aponeurosis, posteriorly with the rectus abdominis. *Direction*.—Nearly vertical. *Structure*.—Aponeurotic at its sum-

mit and base. *Use.*—It acts but very feebly, and in the direction of the rectus muscle.

*Abdominal Aponeurosis.*

This being, as it were, the expansion of the tendons of the abdominal muscles, presents on the median line, 1st, The linea alba, where the external oblique muscles are inserted. 2d, The linea semilunaris, formed by the meeting of all the tendons on the edge of the rectus muscle, to form a sheath for this latter, which is effected in the following manner:—All the tendons meeting and adhering at the linea semilunaris separate; the flat tendons of both the oblique muscles pass on the outer surface of the recti, and form the anterior part of the sheath; while the tendon of the transversalis muscle passes behind, and forms the posterior part. On the posterior part of the rectus this sheath ceases, about five or six inches above the os pubis, so that the pyramidal and recti muscles lie in contact with the bladder and other abdominal viscera, lined only by the peritoneum. 3d, The external abdominal ring, also formed by the tendon of the external oblique muscle, is situated about an inch and a half above the os pubis, looking downward, forward, and inward. It consists of two pillars; the portion of the tendon of the external oblique muscle, which forms the upper pillar, passes downward and inward, and is fixed to the ligament of the symphysis pubis; some of the fibres pass across, and, decussating with those of the opposite side, terminate there; that portion of the tendon which forms the inferior pillar is folded under the spermatic cord, passes inward, and is inserted into the spinous process of the os pubis and linea ilio-pectinea for the space of about an inch. The portion of the tendon of the external oblique muscle passing between the antero-superior spinous process of the ilium and the symphysis pubis, is termed Poupart's ligament.

## 2. LUMBAR REGION.

*Psoas Major.*

*Situation.*—On the inferior and lateral part of the vertebral column, on the lateral part of the superior strait of the pelvis, and at the supero-anterior part of the thigh. *Figure.*—Elongated, fusiform, thicker in the middle than at its extremities. *Attachment.*—Superiorly to the side of the body, and to the transverse processes of the first four lumbar vertebræ, to the lateral inferior part of the body of the last dorsal, and to the fibro-cartilages which separate the above lumbar vertebræ; inferiorly to the summit of the little trochanter. *Relations.*—On the outer and anterior sides with the diaphragm, peritoneum, kidney, psoas minor, external iliac artery, crural artery and vein; on the inner side with the bodies of the lumbar vertebræ, the fibro-cartilages which separate them, the external iliac vein, the tendon of the psoas minor, pectineus; posteriorly with the quadratus lumborum, lumbar nerves, anterior fold of the aponeurosis of the transversus abdominis, transverse processes of the lumbar vertebræ, ilio-lumbar ligament, iliacus muscle, ilium, and capsule of the ilio-femoral articulation. *Direction.*—Vertical in its superior third; oblique from above downward, and from within outward, in its middle third; and from without inward, and from before backward, in its inferior third. *Structure.*—Tendinous at its inferior attachment, aponeurotic at its superior, fleshy in the rest of its extent. *Use.*—It flexes the thigh and directs it a little on the inside, and at the same time rotates it outward. It may also flex the trunk and turn it a little to its side.

*Psoas Minor.*

*Situation.*—In front of the preceding. *Figure.*—Elongated, thin, and narrow. *Attachment.*—Superiorly to the body of the last dorsal vertebra, and to the fibro-cartilage which separates it from the first lum-

bar; inferiorly to the ileo-pectineal eminence, and to the external part of the posterior edge of the body of the pubis. *Relations*.—Anteriorly with the diaphragm, the renal vessels and nerves, the peritoneum, the external iliac artery; posteriorly with the psoas major. *Direction*.—Oblique from above downward and from without inward. *Structure*.—Tendinous in its two inferior thirds. *Use*.—It slightly flexes the vertebral column on the pelvis, or this latter on the vertebral column.

### *Iliacus Internus.*

*Situation*.—In the iliac fossa, and at the superior and anterior part of the thigh. *Figure*.—Flattened, broad, radiated, triangular. *Attachment*.—Superiorly to the two superior thirds of the iliac fossa, and to the two anterior thirds of the internal border of the crest of the ilium, to the internal border of the superior and inferior spinous processes of the ilium, and to the ilio-lumbar ligament; inferiorly to the summit of the little trochanter by a tendon common to it with the psoas major. *Relations*.—Anteriorly with the peritoneum, with the cœcum on the right side, with the sigmoid flexure of the colon on the left; more inferiorly with the sartorius and pectineus muscles, and the crural vessels and nerves; posteriorly with the iliac fossa, with the superior extremity of the rectus femoris muscle and ilio-femoral articulation. *Direction*.—A little oblique from above downward and from without inward. *Structure*.—Tendinous at its inferior attachment, fleshy in the rest of its course. *Use*.—It flexes the pelvis on the thigh, and the thigh on the pelvis.

### *Quadratus Lumborum.*

*Situation*.—At the infero-lateral part of the vertebral column. *Figure*.—Square. *Attachment*.—Superiorly to the inferior edge of the last false rib; inferiorly to the posterior and middle part of the crest of the ilium, and to the ilio-lumbar ligament; on the inner side to

the summit of the transverse processes of the first four lumbar vertebræ, by aponeurotic slips. *Relations*.—Anteriorly with the diaphragm and the psoas major muscles; corresponding directly with the kidney and colon; posteriorly with the mass of the sacro-lumbalis and longissimus dorsi muscles. *Direction*.—Vertical. *Structure*.—Aponeurotic at its attachments. *Use*.—It depresses the twelfth rib, and contributes to bend laterally the lumbar vertebræ.

### 3. ANAL REGION.

#### *Levator Ani.*

*Situation*.—At the inferior part of the pelvis. *Figure*.—Flat, thin, quadrilateral, broader superiorly than inferiorly. *Attachment*.—Superiorly to the inferior and posterior part of the symphysis pubis, to the superior part of the obturator foramen, and to the spine of the ischium; inferiorly, the middle and anterior fibres unite beneath the rectum enveloping this intestine; the most anterior seem attached to the prostate gland; other fibres spread backward on the bulb of the urethra; and the posterior fibres pass to the base of the sides of the os coccygis, forming a tendinous raphe. *Relations*.—On the outer side with the obturator internus, glutæus maximus, and transversus perinæi muscles; on the inner side with the bladder and prostate gland, and inferior part of the rectum. *Direction*.—Oblique from above downward, from without inward, and from before backward. *Structure*.—Entirely fleshy.

In woman this muscle adheres strongly to the vagina before arriving at the rectum. In some cases there is an intermixture of the fibres of this muscle and those of the muscle of Wilson, termed the levator urethræ; the fibres of this latter muscle seem to descend from the symphysis pubis, and pass around and suspend the membranous part of the urethra; it is nothing more than the anterior fibres of the levator ani, and scarcely demands a distinct name. *Use*.—The levator ani muscle elevates the rectum, carries it forward, and compresses it.



*Coccygus.*

*Situation.*—At the posterior and inferior part of the cavity of the pelvis, behind and above the preceding. *Figure.*—Thin, flat, triangular. *Attachment.*—By its summit to the internal border of the spine of the ischium; by its base to the edge of the os coccygis, and to the inferior part of the border of the sacrum. *Relations.*—Posteriorly with the sacro-sciatic ligaments, anteriorly with the rectum. *Direction.*—Its fibres diverge towards the sacrum and os coccygis. *Structure.*—Formed of a mixture of fleshy and aponeurotic fibres. *Use.*—It retains the coccyx, and prevents it from going too far back during defecation.

*Sphincter Ani Externus.*

*Situation.*—Around the inferior extremity of the rectum, extending about a finger's breadth. *Figure.*—Membranous, oval, open in the middle. *Attachment.*—To the summit of the os coccygis by a species of cellular tendon, from whence two fleshy fasciculi proceed, uniting together in front of the anus. *Relations.*—Inferiorly with the skin, superiorly with the levator ani. *Direction.*—Fibres circular. *Structure.*—Fleshy. *Use.*—It contracts the anus and closes this opening. In man it carries the bulb of the urethra forward.

## 4. THE GENITAL REGION.

## 1. IN THE MALE.

*Cremaster.*

*Situation.*—On the spermatic cord and external part of the tunica vaginalis. *Figure.*—Thin, elongated, narrow, broader inferiorly than superiorly. *Attachment.*—Superiorly continuous with the fibres of the inferior border of the obliquus internus abdominis, and a little with those of the transversalis; inferiorly expanding on the external inferior part of the tunica vaginalis. *Direction.*—Oblique from above



downward and from without inward. *Structure*.—Fleshy. *Use*.—It raises the testicle, and approximates it to the inguinal ring.

### *Erector Penis.*

*Situation*.—Along the ramus of the ischium and roots of the corpus cavernosum. *Figure*.—Elongated, flat, broader in the middle than at the extremities. *Attachment*.—Inferiorly to the internal side of the tuber ischii; superiorly to the root of the penis, where it is confounded with the fibrous membrane of the corpus cavernosum. *Relations*.—On the outer side with the corpus cavernosum and ramus ischii; on the inner side with the transversus perinæi and accelerator urinæ. *Direction*.—Oblique from below upward, from without inward, and from behind forward. *Structure*.—Aponeurotic at its extremities, fleshy in the rest of its extent. *Use*.—It brings the penis downward and backward.

### *Accelerator Urinæ.*

*Situation*.—At the middle part of the perinæum, beneath the bulb of the urethra and root of the penis. *Figure*.—Elongated, flat, broader posteriorly than anteriorly. *Attachment*.—By its internal border to the tendinous raphe which separates it from that of the opposite side; by its external border to the side of the bulb of the urethra; by its anterior extremity to the fibrous membrane of the corpus cavernosum; by its posterior extremity, confounded with that of the opposite side, with the transversus perinæi and sphincter ani muscles. *Relations*.—Superiorly with the bulb of the urethra, the commencement of its spongy portion, and corpus cavernosum; inferiorly with the skin, sphincter ani, and erector penis muscles. *Direction*.—Oblique from behind forward, from within outward, and a little from below upward. *Use*.—It brings the posterior part of the canal of the urethra upward and backward, compresses it, and contributes to accelerate the emission of urine and semen.

*Transversus Perinæi.\**

*Situation.*—At the posterior part of the perinæum. *Figure.*—Flat, thin, irregular, often triangular. *Attachment.*—On the outer side to the internal part of the ramus and tuberosity of the ischium; on the inner side, blended on the median line with its fellow of the opposite side, with the anterior part of the sphincter ani muscle, and posterior extremity of the accelerator urinæ. *Relations.*—Anteriorly and a little inferiorly with the accelerator urinæ and erector penis; posteriorly with the levator ani; and outwardly with the deep branch of the internal pubic artery. *Direction.*—Transverse. *Structure.*—Fleshy. *Use.*—It compresses the urethra, and serves to support the bladder and the lower part of the rectum.

## 2. IN THE FEMALE.

*Erector Clitoridis.*

Situated nearly as is the erector penis in the male, but less voluminous. *Attachment.*—On the outer side to the tuber ischii; on the inner embracing the corpus cavernosum of the clitoris. *Use.*—It contributes to erect the clitoris.

*Constrictor Cunni.*

*Situation.*—Around the inferior orifice of the vagina. *Figure.*—Annular. *Attachment.*—Blended posteriorly between the anus and vulva, with the sphincter and transversus perinei muscles; turning on either side around the vagina above the superior labia; uniting anteriorly by an aponeurotic tissue with the fibrous membrane of the corpus cavernosum of the clitoris. *Use.*—It contracts the orifice of the vagina.

\* Frequently wanting in the female.

## IV. MUSCLES OF THE POSTERIOR PART OF THE TRUNK.

The posterior part of the trunk is divided into six regions.

## 1. LUMBO-DORSAL REGION.

*Trapezius.*

*Situation.*—At the posterior part of the neck and shoulder, and at the superior part of the back. *Figure.*—Very broad, flat, and triangular. *Attachment.*—Superiorly to the internal third of the superior curved line of the occipital bone, to the posterior cervical ligament, and to the spinous process of the seventh cervical vertebra; inferiorly to the spinous processes of all the dorsal vertebræ; on the outer side to the spine of the scapula, to the acromion process, and to the external third of the posterior border of the clavicle. *Relations.*—Posteriorly with the skin; anteriorly with the complexus major, splenius, levator anguli scapulæ, serratus posticus superior, supra et infra-spinatus, rhomboideus, latissimus dorsi, and longissimus dorsi muscles, and the internal extremity of the spine of the scapula. *Direction.*—Superior fibres, oblique from above downward and from within outward; the middle, horizontal; the inferior, oblique from below upward and from within outward. *Structure.*—Aponeurotic at its insertions, fleshy in the rest of its extent. *Use.*—The entire muscle carries the shoulder backward; its upper portion raises it, the lower depresses it. If the shoulder be fixed, the trapezius may incline the head backward towards the shoulder.

*Latissimus Dorsi.*

*Situation.*—At the posterior and inferior part of the trunk. *Figure.*—Quadrilateral, broader superiorly than inferiorly. *Attachment.*—Inferiorly to the posterior half of the external lip of the crest of the ili-

um, and to the posterior face of the sacrum; on the inner side to the spinous processes of all the lumbar vertebræ, and to those of the six or seven inferior dorsal; on the outer side to the last four false ribs by as many digitations; in fine, superiorly to the posterior border of the bicipital groove of the humerus, and sometimes to the inferior angle of the scapula. *Relations*.—Posteriorly with the skin and trapezius; anteriorly with the obliquus abdominis internus, et externus, serratus posticus minor, longissimus dorsi, inferior intercostals, serratus magnus, rhomboideus, teres major, and infra-spinatus muscles, the inferior ribs, and inferior angle of the scapula. *Direction*.—Superior fibres, horizontal; middle, oblique from below upward and from within outward; anterior, vertical. *Structure*.—Aponeurotic at its internal and inferior part, tendinous at its insertion at the humerus, fleshy in other parts. *Use*.—It draws the upper limb downward, inward, and backward. If the arm be fixed, it may also draw the ribs to which it is attached, and even move the trunk on the upper limb.

## 2. DORSO-CERVICAL REGION.

### *Rhomboideus Major et Minor.*

*Situation*.—At the posterior and inferior part of the neck, and superior part of the back. *Figure*.—Broad, thin, flattened, and square. *Attachment*.—By its internal border to the inferior part of the posterior cervical ligament, to the spinous process of the seventh cervical, and to those of the four or five first dorsal vertebræ; by its external border to the four inferior fifths of the interstice of the base of the scapula. *Relations*.—Posteriorly with the trapezius, and a little with the latissimus dorsi; anteriorly with the serratus posticus superior, splenius, longissimus dorsi, and external intercostal muscles. *Direction*.—Oblique from within outward and from above downward. *Structure*.—Aponeurotic at its internal and external border; divided by a cellular line into two portions, the

superior the smallest. *Use*.—It carries the scapula backward, inward, and a little upward.

*Levator Anguli Scapulæ.*

*Situation*.—At the posterior and lateral part of the neck, and superior part of the back. *Figure*.—Elongated, flat, broader inferiorly than superiorly. *Attachment*.—Superiorly to the posterior tubercle of the transverse processes of the first four cervical vertebræ; inferiorly to the posterior angle of the scapula, and to the internal part of its superior border. *Relations*.—On the outer side with the sterno-mastoideus, skin, and trapezius; on the inner side with the serratus posticus superior, sacro-lumbalis, transversalis colli, and splenius. *Direction*.—Oblique from above downward, from before backward, and from within outward. *Structure*.—Tendinous at its insertions, fleshy in other parts. *Use*.—It raises the upper angle of the scapula, and brings down its anterior angle, depressing the shoulder. If the scapula is fixed, this muscle inclines the neck to the shoulder.

*Serratus Posticus Superior.*

*Situation*.—At the posterior and inferior part of the neck, and at the superior part of the back. *Figure*.—Flat, thin, and quadrilateral. *Attachment*.—By its internal edge to the inferior part of the posterior cervical ligament, to the spinous process of the seventh cervical vertebra, and to those of the two or three first dorsal; by its external edge to the external surface and superior border of the 2d, 3d, 4th, and 5th true ribs. *Relations*.—Posteriorly with the rhomboideus, levator anguli scapulæ, serratus magnus, trapezius; anteriorly with the splenius, sacro-lumbalis, ribs, and external intercostal muscles. *Direction*.—Oblique from within outward and from above downward. *Structure*.—Aponeurotic at its internal half, fleshy in its outer half. *Use*.—It raises the ribs to which it is attached.

*Serratus Posticus Inferior.*

*Situation.*—At the inferior part of the back. *Figure.*—Quadrilateral, broad, flat, and thin. *Attachment.*—By its internal edge to the spinous processes of the two or three last dorsal vertebræ, and to those of the first three lumbar; by its external edge to the inferior edge of the last four false ribs. *Relations.*—Posteriorly with the latissimus dorsi; anteriorly with the last three ribs, the corresponding intercostal muscles, and posterior fold of the aponeurosis of the transversus abdominis muscle. *Direction.*—A little oblique from within outward and from below upward. *Structure.*—Aponeurotic in its internal half, fleshy in the external. *Use.*—It depresses the ribs to which it is inserted.

## 4. SUPERFICIAL CERVICO-OCCIPITAL REGION.

*Splenius Capitis.*

*Situation.*—At the posterior part of the neck and superior part of the back. *Figure.*—Elongated, flattened, narrower inferiorly than superiorly, where it is divided into two portions. *Attachment.*—By its internal border to the spinous processes of the five or six first dorsal vertebræ, to that of the seventh cervical, and to the inferior third of the posterior cervical ligament; by its superior extremity to the summit of the transverse processes of the first two or three cervical vertebræ, to the mastoid process of the temporal bone, and to the posterior surface of the occipital bone at the rough impression between its two curved lines. *Relations.*—Posteriorly with the sterno-mastoideus, trapezius, levator anguli scapulæ, serratus posticus superior, and rhomboideus muscles; anteriorly with the complexus major and minor muscles. *Direction.*—Oblique from below upward and from within outward. *Structure.*—Aponeurotic at its attachments, fleshy in the rest of its course. *Use.*—It turns the neck and the head backward from its side. If the two splenii act at the same time, they carry the head backward.

*Complexus.*

*Situation.*—At the posterior part of the neck and superior part of the back. *Figure.*—Elongated, flat, broader superiorly than inferiorly. *Attachment.*—Inferiorly to the transverse and articulating processes of the last six cervical vertebræ, to the transverse processes of the first four or five dorsal; superiorly to the internal portion of the rough surface observed between the two curved lines of the occipital bone. *Relations.*—Posteriorly with the trapezius, splenius, and trachelo-mastoideus muscles; anteriorly with a part of the semi-spinalis dorsi, arteria cervicalis profunda, posterior branches of the cervical nerves, and the rectus capitis posticus minor and obliquus capitis inferior muscles. *Direction.*—Oblique from below upward, from without inward, and from before backward. *Structure.*—Tendinous at its insertions, formed of a mixture of aponeurotic and muscular fibres. *Use.*—It brings the head backward and to its side; the two muscles carry it backward.

*Trachelo-mastoideus.*

*Situation.*—At the posterior and lateral part of the neck. *Figure.*—Elongated, flat, thin, and narrow. *Attachment.*—Inferiorly to the transverse processes of the last four cervical vertebræ, and sometimes to the first dorsal; superiorly to the posterior part of the mastoid process of the temporal bone. *Relations.*—Posteriorly with the splenius and transversalis colli muscles; anteriorly with the great complexus and obliquus capitis, with the posterior end of the digastricus, and the occipital artery. *Direction.*—Vertical. *Structure.*—Tendinous at its insertions, fleshy in other parts; presenting aponeurotic fibres mixed with the muscular. *Use.*—It brings the head backward and to its side; these two muscles bring it directly backward.



## 5. DEEP CERVICAL-OCCIPITAL REGION.

*Rectus Capitis Posticus Major.*

*Situation.*—At the posterior and superior part of the neck. *Figure.*—Elongated, flat, triangular, broader superiorly than inferiorly. *Attachment.*—Inferiorly to the summit of the spinous process of the axis; superiorly, underneath the inferior curved line of the occipital bone, between the rectus capitis posticus minor and obliquus capitis superior muscles. *Relations.*—Posteriorly with the great complexus and obliquus capitis superior; anteriorly with the occipital bone, the posterior arch of the atlas, the posterior ligament uniting the axis and atlas, the rectus capitis posticus minor, and vertebral artery. *Direction.*—Oblique from below upward, from within outward, and a little from before backward. *Structure.*—Tendinous at its insertions, fleshy in other parts. *Use.*—It extends the head, and rotates it slightly to its side.

*Rectus Capitis Posticus Minor.*

*Situation.*—At the posterior and superior part of the neck. *Figure.*—Triangular and flat. *Attachment.*—Inferiorly to the tubercle at the posterior arch of the atlas; superiorly to the external face of the occipital bone, behind the occipital foramen, also a little to the side of the inferior curved line. *Relations.*—Posteriorly with the great complexus; anteriorly with the occipital bone, the posterior atlanto-occipital ligament, and the vertebral artery. *Direction.*—A little oblique from below upward and from before backward. *Structure.*—Aponeurotic at its insertions, but fleshy in other parts. *Use.*—It inclines the head backward on the atlas.

*Obliquus Capitis Inferior.*

*Situation.*—At the posterior and superior part of the neck. *Figure.*—Fusiform, elongated, and rounded. *Attachment.*—By one portion to the summit of the



spinous process of the axis, near the rectus capitis posticus major; and by the other, to the summit of the transverse process of the atlas. *Relations*.—Posteriorly with the great and little complexus; anteriorly with the plate of the second vertebra, the posterior ligament uniting the axis and atlas, and the vertebral artery. *Direction*.—Oblique from below upward, from within outward, and from behind forward. *Structure*.—Tendinous at its insertions, fleshy in other parts. *Use*.—It gives the atlas a rotatory motion, which turns the face to its side.

### *Obliquus Capitis Superior.*

*Situation*.—At the posterior, superior, and lateral part of the neck. *Figure*.—Elongated, flat, narrower inferiorly than superiorly. *Attachment*.—Inferiorly to the summit of the transverse process of the first cervical vertebra in front of the preceding; superiorly beneath the external portion of the superior curved line of the occipital bone. *Relations*.—Posteriorly with the great and little complexus and splenius muscles; anteriorly with the occipital bone and vertebral artery, and with the attachment of the rectus capitis posticus major. *Direction*.—Oblique from above downward, from within outward, and from behind forward. *Situation*.—Tendinous at its insertions. *Use*.—It extends the head, and inclines it to its side.

## 6. VERTEBRAL REGION.

### *Longissimus Dorsi.*

*Situation*.—At the posterior part of the trunk. *Figure*.—Quadrilateral and thick inferiorly, thin, flat, and terminating in a point superiorly. *Attachment*.—To the posterior part of the sacrum, to the transverse processes of all the lumbar and dorsal vertebræ, and to the inferior border of the seven or eight last ribs. *Relations*.—On the inner side with the semi-spinalis dorsi, transversalis colli, and great complexus; on the

outer side with the *sacro-lumbalis*; anteriorly with the *levatores costarum longiores et breviores*, the ribs, the transverse processes, the superior costo-transverse ligaments, the dorsal vessels and nerves, and a portion of the external intercostal muscles; posteriorly with the aponeurosis of the *obliquus internus* and *transversalis abdominis*, *serratus posticus superior*, *latissimus dorsi*, *trapezius*, *rhomboideus*, and *splenius* muscles. *Direction*.—Vertical. *Structure*.—Aponeurotic at its postero-inferior part; terminated by a great number of small tendons for its insertion into the transverse processes and to the ribs. *Use*.—It prevents the trunk from bending forward, carries it backward and a little to the side, and draws the ribs downward.

### *Sacro-lumbalis.*

*Situation*.—At the posterior part of the trunk. *Figure*.—Elongated, thick, and triangular below; flat and thin in the rest of its extent, terminating in a point superiorly. *Attachment*.—To the posterior face of the sacrum, to the posterior part of the crest of the ilium, to the summit of the transverse processes of the lumbar vertebræ, to the angle of the eleven inferior ribs, to the tuberosity of the first, and to the posterior tubercle of the transverse processes of the four or five inferior cervical vertebræ. *Relations*.—Posteriorly with the same parts as the preceding; anteriorly with the aponeurosis of the *transversalis abdominis* muscle, the ribs, the external intercostal muscles, the *lumbocostalis* and *transversalis colli* muscles; on the inner side with the *longissimus dorsi*; on the outer with the point of union of the two posterior folds of the aponeurosis of the *transversalis abdominis* muscle. *Direction*.—A little oblique from below upward and from within outward. *Structure*.—Aponeurotic at its postero-inferior part, terminating by small tendons for its attachment to the ribs and cervical vertebræ, fleshy in the rest of its extent. *Use*.—Same as preceding.

*Transversalis Colli.*

*Situation.*—At the posterior and lateral part of the neck, and at the superior part of the back. *Figure.*—Elongated, flattened from within outward, thin, and narrow. *Attachment.*—To the transverse processes of the eighth, seventh, sixth, fifth, fourth, and third dorsal vertebræ, and to the posterior tubercle of the transverse processes of the fifth, fourth, third, and second cervical vertebræ, not being attached to the first dorsal nor to the last cervical vertebra. *Relations.*—Posteriorly with the trachelo-mastoideus, levator anguli scapulæ, and longissimus dorsi muscles; anteriorly with the transverse processes of the vertebræ; on the outer side with the splenius, levator anguli scapulæ, and sacro-lumbalis; on the inner side with the complexus major and minor muscles, and a portion of the semi-spinalis dorsi. *Direction.*—A little oblique from below upward and from within outward. *Structure.*—Terminating by small tendons for its attachment to the vertebræ, which are mixed with fleshy fibres, and blended with those of the neighbouring muscles. *Use.*—It serves to extend the vertebræ.

*Semi-spinalis Dorsi, et Multifidus Spinæ.*

*Situation.*—At the internal part of the vertebral groove, from the axis as far as the sacrum. *Figure.*—Triangular and elongated; thicker in the neck and loins than in the back and behind the sacrum; appearing like a single fleshy bundle. *Attachment.*—To the spinous, transverse, and articulating processes of the last six cervical, of the twelve dorsal, and five lumbar vertebræ, and to the posterior surface of the sacrum. *Relations.*—Posteriorly with the great complexus muscle, arteria cervicalis profunda, posterior cervical nerves, and longissimus dorsi; anteriorly with the plates of the vertebræ, their transverse and articulating processes, and the ligamenta subflava; on the inner side with the spinous processes, the inter-

spinales cervicis, and the dorsal and lumbar interspinous ligaments. *Direction*.—The fasciculi composing it are oblique from below upward and from without inward, directed from the transverse processes to the spinous processes. *Structure*.—All the fasciculi terminate by tendons for their attachments. *Use*.—It extends the vertebral column, and inclines it a little to its side, imparting to it a slight rotatory motion.

### *Interspinales Cervicis.*

*Number*.—Six on each side. *Situation*.—In the intervals of the spinous processes of the neck. *Figure*.—Quadrilateral, very small, flattened transversely. *Attachment*.—To the inferior edge of the spinous process of the vertebra which is superior, and to the superior border of the spinous process of the vertebra which is inferior. *Relations*.—On the outer side with the semi-spinalis dorsi, on the inner with that of the opposite side. *Direction*.—Vertical. *Structure*.—Fleshy, except at its attachments. *Use*.—They approximate the spinous processes, and tend to straighten the vertebral column.

### *Inter-transversales Colli.*

These are divided into the anterior, six in number on each side, and the posterior, five in number. *Situation*.—Between the transverse processes of the cervical vertebræ. *Figure*.—Quadrilateral, small, thin, and flat. *Attachment*.—To the inferior edge of the transverse process of the vertebræ above, and to the superior edge of the transverse process of the vertebræ below. *Relations*.—1st, The anterior set, in front, with the rectus capitis anticus major; 2d, The posterior set, behind, with the splenius, transversalis colli, and sacro-lumbalis. *Direction*.—Vertical. *Structure*.—Fleshy, except at their insertions. *Use*.—They approximate the transverse processes, and incline the neck to their side.

*Inter-transversales Lumborum.*

*Situation.*—Between the lumbar transverse processes. *Number.*—Five on each side. *Figure.*—Quadrilateral, flat, and thin. *Attachment.*—To the superior border of the transverse process of the vertebra beneath, and to the inferior border of that above. *Relations.*—Posteriorly with the sacro-lumbalis; anteriorly with the quadratus lumborum. *Direction.*—Vertical. *Structure.*—Aponeurotic at their attachments. *Use.*—They incline laterally the lumbar region of the vertebral column.

## MUSCLES OF THE EXTREMITIES.

## 1. SUPERIOR EXTREMITIES.

The muscles of the superior extremities comprise those of the shoulder, arm, fore-arm, and hand.

## I. MUSCLES OF THE SHOULDER.

They occupy three regions.

## 1. POSTERIOR SCAPULAR REGION.

*Supra-spinatus.*

*Situation.*—On the superior and posterior part of the shoulder, in the supra-spinatus fossa of the scapula. *Figure.*—Triangular, pyramidal, and thick. *Attachment.*—On the inner side to the two internal thirds of the supra-spinatus fossa; on the outer side to the superior surface of the greater tuberosity of the humerus. *Relations.*—Posteriorly with the trapezius and deltoides muscles and the coraco-acromian ligament; anteriorly with the supra-spinatus fossa and capsule of the shoulder joint. *Direction.*—Oblique from within outward and from below upward. *Structure.*—Tendinous at its insertion into the humerus,

fleshy in the rest of its extent. *Use*.—It raises the arm, and turns it outward.

*Infra-spinatus.*

*Situation*.—In the infra-spinatus fossa, beneath the preceding. *Figure*.—Thick, triangular, and flattened from before backward. *Attachment*.—On the inner side to the three internal fourths of the infra-spinatus fossa; on the outer side to the middle surface of the great tuberosity of the humerus. *Relations*.—Posteriorly with the deltoides, trapezius, and latissimus dorsi muscles, and the integuments; anteriorly with the infra-spinatus fossa, from which it is separated, in its external third, by the superior scapular nerves and vessels, and with the capsule of the shoulder joint. *Direction*.—Oblique from within outward and from below upward. *Structure*.—Tendinous at its humeral insertion. *Use*.—It rotates the arm outward and backward.

*Teres Minor.*

*Situation*.—At the posterior and inferior part of the shoulder, along the side of the scapula. *Figure*.—Narrow, elongated, flattened. *Attachment*.—On the inner side to the posterior surface of the scapula, near its inferior angle; on the outer side to the inferior small surface of the great tuberosity of the humerus. *Relations*.—Posteriorly with the deltoides and skin; anteriorly with the external scapular artery, the long portion of the triceps, and the capsule of the articulation of the shoulder joint; superiorly with the infra-spinatus muscle; inferiorly with the teres major, from which it is separated by the long portion of the triceps. *Direction*.—Oblique from below upward and from within outward. *Structure*.—Tendinous at its attachment to the humerus. *Use*.—It separates the arm from the trunk, and raises it slightly.

*Teres Major.*

*Situation.*—At the posterior and inferior part of the shoulder. *Figure.*—Elongated, flattened, and about an inch and a half in breadth. *Attachment.*—On the inner side to the quadrilateral surface which terminates inferiorly the infra-spinatus fossa, to the inferior third of the external border of the scapula; on the outer side to the posterior border of the bicipital groove of the humerus. *Relations.*—Posteriorly with the latissimus dorsi, the skin, with the humerus, and long portion of the triceps; anteriorly with the subscapularis, latissimus dorsi, coraco-brachialis, and biceps muscles, axillary vessels and brachial plexus, with the latissimus dorsi, forming with it the posterior border of the axilla; superiorly with the teres minor, from which it is separated by the long portion of the triceps. *Direction.*—Oblique from below upward and from within outward. *Structure.*—Tendinous at its attachment to the humerus. *Use.*—It carries the arm backward and inward, turning it on its axis.

## 2. ANTERIOR SCAPULAR REGION.

*Sub-scapularis.*

*Situation.*—In the sub-scapular fossa. *Figure.*—Triangular, broad, flat, and thick. *Attachment.*—On the inner side to the three internal fourths of the subscapular fossa, and to the anterior lip of the axillary border of the scapula; on the outer side to the lesser tuberosity of the humerus. *Relations.*—Anteriorly with the serratus magnus, muscle, the brachial plexus, the axillary artery, and the coraco-brachialis, biceps, and deltoid muscles; posteriorly with the subscapular fossa, a little with the teres major, the long portion of the triceps brachialis, and with the capsule of the shoulder joint. *Direction.*—Oblique from within outward and from below upward. *Structure.*—Tendinous at its attachment with the humerus, apo-

neurotic at its other insertions, and fleshy in other parts. *Use*.—It rotates the arm inward, and brings it near the trunk.

### *Deltoides.*

*Situation*.—At the external part of the shoulder, and superior and external part of the arm. *Figure*.—Triangular, broad, thick, and flattened from above downward. *Attachment*.—Superiorly to the external third of the anterior border of the clavicle, to the inferior border of the acromion process, to the whole inferior lip of the posterior border of the spine of the scapula; inferiorly to the deltoid impression in the middle part of the external face of the humerus. *Relations*.—On the outer side with the skin and platysma myoides; on the inner side with the infra-spinatus, teres minor, and triceps brachialis muscles; with the coraco-acromian ligament, the coracoid process, the capsule of the shoulder joint, the superior third of the external surface of the humerus, and tendon of the pectoralis major; anteriorly with the pectoralis major, from which it is separated by the cephalic vein; here it is parallel to the external border of the biceps. *Direction*.—The anterior fibres are oblique from above downward and from before backward; the middle are vertical; the posterior are oblique from above downward and from behind forward. *Structure*.—Tendinous at its apex, which is inferior; aponeurotic in its superior insertions, and fleshy elsewhere. *Use*.—It raises the arm and carries it outward.

## MUSCLES OF THE ARM.

The arm is divided into two regions.

### 1. ANTERIOR BRACHIAL REGION.

#### *Coraco-brachialis.*

*Situation*.—At the superior and internal part of the arm. *Form*.—Elongated, flattened, and narrow. *Attachment*.—Superiorly to the summit of the coracoid



process; inferiorly to the middle part of the internal face and edge of the humerus. *Relations*.—Anteriorly with the deltoid, biceps, and pectoralis major muscles; posteriorly with the sub-scapularis, the tendon of the latissimus dorsi and teres major muscles, the axillary artery, musculo-cutaneous and median nerve (the former of which pierces it), and with the brachial artery. *Direction*.—A little oblique from above downward, from before backward, and from within outward. *Structure*.—Tendinous at its attachments, fleshy in its centre. *Use*.—It flexes the arm on the fore-arm, or this latter on the arm, and brings the hand to supination.

### *Biceps Brachialis.*

*Situation*.—At the anterior and inferior part of the arm. *Figure*.—Elongated, thick in its middle portion, thin at its extremities, the superior of which is divided into two portions, the one external, the other internal. *Attachment*.—Superiorly by its short portion to the summit of the coracoid process, and by its long portion to the superior part of the glenoid cavity of the scapula; inferiorly to the bicipital tuberosity of the radius. *Relations*.—Anteriorly with the deltoid and pectoralis major muscles, the brachial aponeurosis, and the skin; posteriorly with the humerus, coracobrachialis, and brachialis internus muscles, and the musculo-cutaneous nerve; on the inner side with the coraco-brachialis superiorly, and with the brachial artery in the middle and inferiorly. *Direction*.—Vertical. *Structure*.—Tendinous at its extremities, fleshy in its centre. *Use*.—It flexes the arm on the fore-arm, or the latter on the arm, and brings the hand to a state of supination.

### *Brachialis Internus.*

*Situation*.—At the anterior and inferior part of the arm. *Figure*.—Elongated, flattened from before backward, broader in the middle and superiorly than inferiorly. *Attachment*.—Superiorly to the external

and internal faces of the humerus, to its external, internal, and anterior edges, from the attachment of the deltoid muscle, as far as the articulation of the elbow joint, and to the internal and external intermuscular aponeuroses; inferiorly to the rough surface beneath the coronoid process of the ulna. *Relations*.—Anteriorly with the brachial aponeurosis and the skin, the supinator radii longus and biceps muscles, the musculo-cutaneous nerve, brachial artery, median nerve, and pronator teres muscle; posteriorly with the inferior part of the humerus and articulation of the elbow joint. *Direction*.—Vertical. *Structure*.—Tendinous at its attachments, and fleshy elsewhere. *Use*.—It extends the fore-arm on the arm, and tenses the antibrachial aponeurosis.

## 2. POSTERIOR BRACHIAL REGION.

### *Triceps Brachialis.*

*Situation*.—At the posterior part of the arm. *Figure*.—Elongated, flattened from before backward, very thick; divided superiorly into three portions; one external, one middle, and one internal. *Attachment*.—Superiorly to nearly the whole of the posterior face of the humerus, to its external and internal borders, to the inter-muscular aponeuroses by its internal and middle portions, and to the most elevated part of the axillary border of the scapula by its external or long portion; inferiorly to the superior and posterior part of the olecranon. *Relations*.—Posteriorly and superiorly with the deltoid and teres minor muscles; anteriorly with the sub-scapularis, teres major, and latissimus dorsi muscles; with the capsule of the scapulo-humeral articulation, with the posterior surface of the humerus, and posterior part of the articulation of the elbow joint. *Direction*.—Vertical. *Structure*.—Tendinous at its attachments, and fleshy elsewhere. *Use*.—It extends the fore-arm on the arm, and tenses the antibrachial aponeurosis.

## MUSCLES OF THE FORE-ARM.

## 1. SUPERFICIAL ANTERIOR ANTI-BRACHIAL REGION.

*Pronator Teres.*

*Situation.*—At the anterior and superior part of the fore-arm. *Figure.*—Elongated, flat, larger superiorly than inferiorly. *Attachment.*—Superiorly to the anterior part of the internal condyle of the humerus, and to the internal side of the coronoid process, between which two portions the median nerve passes; inferiorly to the middle part of the external surface of the radius. *Relations.*—Anteriorly with the anti-brachial aponeurosis, the skin, the supinator radii longus, the radial vessels and nerves, and external radial muscles; posteriorly with the brachialis internus and flexor sublimis muscles, the median nerve, and ulnar artery; on the inner side with a triangular space for the tendon of the biceps, brachial artery, and median nerve, and with the supinator brevis muscle. *Direction.*—Oblique from above downward and from within outward. *Structure.*—Tendinous at its attachment, fleshy in other parts. *Use.*—It causes in the arm the motion of pronation, by turning the radius on the ulna.

*Radialis Internus.*

*Situation.*—At the anterior part of the fore-arm. *Figure.*—Elongated, flat, broader superiorly than inferiorly. *Attachment.*—Superiorly to the internal condyle of the humerus; inferiorly to the anterior part of the superior extremity of the second metacarpal bone, passing through a groove in the trapezium. *Relations.*—Anteriorly with the supinator radii longus and anti-brachial aponeurosis; posteriorly with the superficial flexor and flexor longus pollicis manus, and the carpal articulation; laterally with the pronator teres and palmaris longus muscle. *Direction.*—A little from above downward, and from within outward. *Structure.*—Tendinous at its extremities, fleshy

elsewhere. *Use*.—It flexes the hand on the fore-arm, and turns it a little inward.

*Palmaris Longus.*

*Situation*.—At the anterior part of the fore-arm. *Figure*.—Elongated, thin, and flattened. *Attachment*.—Superiorly to the internal condyle of the humerus; inferiorly, lost in the superior part of the palmar aponeurosis, but attached partly to the anterior surface of the anterior annular ligament of the carpus. *Relations*.—Anteriorly with the aponeurosis of the fore-arm; posteriorly with the superficial flexor of the fingers. *Direction*.—A little oblique from above downward and from within outward. *Structure*.—Tendinous at its extremities, particularly at the inferior. *Use*.—It tenses the palmar aponeurosis, and flexes the hand on the fore-arm.

*Ulnaris Internus.*

*Situation*.—At the anterior internal part of the fore-arm. *Figure*.—Elongated, flat, broader superiorly than inferiorly. *Attachment*.—Superiorly to the internal condyle of the humerus, to the internal side of the olecranon, and to the posterior border of the ulna; inferiorly to the os pisiforme. *Relations*.—Anteriorly with the anti-brachial aponeurosis; posteriorly with the flexor profundus muscle, ulnar artery and nerve, and the pronator quadratus muscle; on the outer side with the flexor superficialis. *Direction*.—Vertical. *Structure*.—Tendinous at its inferior insertion, aponeurotic at its superior. *Use*.—It flexes the hand, and inclines it on the ulna.

*Flexor Superficialis, vel Perforatus.*

*Situation*.—At the anterior part of the fore-arm. *Figure*.—Elongated, flat, divided into four portions inferiorly. *Attachment*.—Superiorly to the internal condyle of the humerus, to the coronoid process of the ulna, to the internal lateral ligament of the elbow

joint, and to the superior part of the anterior border of the radius; inferiorly by its four tendons to the anterior surface of the second phalanx of the four last fingers. *Relations*.—Anteriorly with the pronator teres, radialis internus, and palmaris longus muscles, the anti-brachial aponeurosis, the annular ligament of the carpus, the palmar aponeurosis, the fibrous sheaths of the fingers, and the tendons of the flexor profundus vel perforans; posteriorly with this latter muscle, with the flexor longus pollicis manus, the median nerve, the ulnar artery, the lumbricales muscles and phalanges. *Direction*.—Vertical. *Structure*.—Terminating inferiorly by four tendons, which are contained in fibrous sheaths, covered by a synovial membrane, and disposed in such a manner as to receive the tendons of the deep flexor. *Use*.—It flexes the first and second phalanges of the fingers.

## 2. DEEP-SEATED ANTERIOR ANTI-BRACHIAL REGION.

### *Flexor Profundus Digitorum, vel Perforans.*

*Situation*.—At the anterior part of the fore-arm. *Figure*.—Elongated, thick, flat, divided into four portions inferiorly. *Attachment*.—Superiorly to the upper three fourths of the anterior and internal surfaces of the ulna, and to the interosseous ligament; inferiorly to the anterior surface of the third phalanx of the last four fingers. *Relations*.—Anteriorly with the superficial flexor and ulnaris internus muscles, the median and ulnar nerves, and the ulnar artery; posteriorly with the anterior and internal surfaces of the ulna, the interosseous ligament, the pronator quadratus, anterior ligaments of the articulation of the carpus and radius, the anterior part of the metacarpus, the flexor brevis, and adductor pollicis manus, and the two last palmar interosseous muscles. *Direction*.—Vertical. *Structure*.—Terminating by four long tendons inferiorly, which traverse the fissure in the tendons of the superficial flexor. *Use*.—It flexes the third phalanges of the fingers, and then the other phalanges, and even the hand.

*Flexor Longus Pollicis Manus.*

*Situation.*—At the anterior part of the fore-arm. *Figure.*—Elongated, flat, thin, thicker on the inner side than on the outer. *Attachment.*—Superiorly to the three superior fourths of the anterior surface of the radius, to the neighbouring portion of the interosseous ligament, and frequently to the coronoid process of the ulna; inferiorly to the anterior face of the last phalanx of the thumb. *Relations.*—Anteriorly with the flexor superficialis, the radialis internus, and supinator radii longus muscles, radial artery, and anterior annular ligament of the carpus; posteriorly with the radius, the interosseous ligament, the pronator quadratus, carpal articulation, anterior portion of the carpus, and flexor brevis pollicis manus muscle; on the inner side with the flexor digitorum profundus muscle. *Direction.*—Vertical. *Structure.*—Tendinous at its lower extremity, fleshy elsewhere. *Use.*—It flexes the second phalanx of the thumb, and consecutively the first phalanx, and even the metacarpal bone.

*Pronator Quadratus.*

*Situation.*—At the anterior and inferior part of the fore-arm. *Figure.*—Square. *Attachment.*—On the inner side to the inferior fourth of the anterior surface of the ulna; on the outer side to the corresponding portion of the same surface of the radius. *Relations.*—Anteriorly with the flexor profundus, flexor longus pollicis manus, radialis internus, and ulnaris internus muscles, and the radial and ulnar arteries; posteriorly with the two bones of the fore-arm and with the interosseous ligament. *Direction.*—Transverse. *Structure.*—Fleshy, except at its attachments, which are aponeurotic. *Use.*—It causes pronation in the hand, turning the radius on the ulna.

## 3. SUPERFICIAL POSTERIOR ANTI-BRACHIAL REGION.

*Extensor Communis Digitorum Manus.*

*Situation.*—At the posterior part of the fore-arm.  
*Figure.*—Elongated, flat, simple superiorly, divided inferiorly into four parts. *Attachment.*—Superiorly to the external condyle of the humerus, to the aponeurosis of the fore-arm, and to the aponeurotic septa of the different muscles in that region; inferiorly to the postero-superior part of the second and third phalanges of the last four fingers. *Relations.*—Posteriorly, with the aponeurosis of the fore-arm; anteriorly with the supinator radii brevis, the abductor longus, and extensor major pollicis manus muscles, the carpal articulation, the posterior surface of the carpus, metacarpus, and fingers, and dorsal interosseous muscles. *Direction.*—Vertical. *Structure.*—Terminating inferiorly by four tendons. *Use.*—It extends the last four fingers.

*Extensor Proprius Digiti Minimi.*

*Situation.*—At the posterior part of the fore-arm.  
*Figure.*—Elongated, thin, and narrow. *Attachment.*—Superiorly to the external condyle of the humerus, and to the aponeurotic septa which separate it from the extensor digitorum communis and ulnaris externus; inferiorly to the posterior face of the last two phalanges of the little finger. *Relations.*—Posteriorly with the aponeurosis of the fore-arm and the skin; anteriorly with the supinator radii brevis, abductor longus, extensor major pollicis manus, and indicator muscles; on the outer side with the extensor communis; on the inner side with the ulnaris externus muscle. *Direction.*—A little oblique from above downward and from without inward. *Structure.*—Tendinous at its extremities, especially at the lower, fleshy in the centre. *Use.*—It extends the little finger.

*Ulnaris Externus.*

*Situation.*—At the posterior and internal part of the fore-arm. *Figure.*—Fusiform, flat, and elongated. *Attachment.*—Superiorly to the external condyle of the humerus, to the intermuscular aponeuroses, and to nearly the middle third of the posterior edge of the ulna; inferiorly to the postero-internal part of the superior extremity of the fifth metacarpal bone. *Relations.*—Posteriorly with the aponeurosis of the fore-arm; anteriorly with the supinator radii brevis, the abductor longus, the extensor major pollicis manus, and the indicator muscles, and with the ulna; on the outer side with the preceding muscle; on the inner side with the anconeus. *Direction.*—Nearly vertical. *Structure.*—Tendinous at its extremities, fleshy in the rest of its extent. *Use.*—It extends the hand, and inclines it a little backward on the ulna.

*Anconeus.*

*Situation.*—At the posterior and superior part of the fore-arm. *Figure.*—Triangular, thick, and short. *Attachment.*—Superiorly to the external condyle of the humerus by a distinct tendon; inferiorly to the superior third of the posterior border and surface of the ulna. *Relations.*—Posteriorly with the aponeurosis of the fore-arm; anteriorly with the annular ligament of the radius, the supinator radii brevis muscles, and with the ulna. *Direction.*—The superior fibres nearly transverse, the others oblique from above downward and from without inward. *Structure.*—Tendinous at its upper insertion, fleshy in other parts. *Use.*—It extends the fore-arm on the arm.

## 4. DEEP POSTERIOR ANTI-BRACHIAL REGION.

*Abductor Longus Pollicis Manus.*

*Situation.*—At the posterior and external part of the fore-arm. *Figure.*—Elongated, flat, broader in the middle than at the extremities. *Attachment.*—Supe-



riorly to a small portion of the posterior surface of the ulna, to a longitudinal line on the posterior surface of this bone, to the superior part of the posterior surface of the radius, and to the interosseous ligament; inferiorly to the external side of the superior extremity of the first metacarpal bone. *Relations*.—Posteriorly with the supinator radii brevis, the ulnaris externus, the extensor minor pollicis manus, the extensor communis digitorum, and the extensor longus pollicis manus muscles; anteriorly with the ulna, interosseous ligament, and radius; in the middle with the tendons of the radialis externus longior et brevior muscles, the radial artery, and articulation of the radius with the carpus. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Tendinous at its inferior attachment, aponeurotic at its superior insertion, fleshy in other parts. *Use*.—It carries the thumb outward and backward.

#### *Extensor Minor Pollicis Manus.*

*Situation*.—At the posterior and inferior part of the fore-arm. *Figure*.—Thin, elongated, broader in its middle portion than at its extremities. *Attachment*.—Superiorly to the posterior face of the radius, and to that of the interosseous ligament; inferiorly to the posterior side of the superior extremity of the first phalanx of the thumb. *Relations*.—Posteriorly with the extensor major pollicis manus, extensor proprius digiti minimi, extensor digitorum, and anti-brachial aponeurosis; anteriorly the relations are the same as with the preceding. *Direction*.—Oblique from above downward and from within outward.

#### *Extensor Major Pollicis Manus.*

*Situation*.—At the posterior part of the fore-arm. *Figure*.—Elongated, flattened, and fusiform. *Attachment*.—Superiorly to the posterior face of the ulna and to that of the interosseous ligament; inferiorly to the posterior side of the superior extremity of the last phalanx of the thumb. *Relations*.—Posteriorly

with the ulnaris externus, extensor proprius minimi digiti, extensor communis digitorum, and indicator muscles; anteriorly with the abductor longus pollicis manus and extensor minor pollicis manus muscles, the two bones of the fore-arm, the interosseous ligament, carpal articulation, tendons of the radialis externus longior et brevior, the first metacarpal bone, and phalanges of the thumb. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Tendinous below, fleshy above. *Use*.—It extends the thumb and particularly the second phalanx.

### *Indicator.*

*Situation*.—At the posterior part of the fore-arm. *Figure*.—Elongated, thin, broader in its middle portion than at its extremities. *Attachment*.—Superiorly to the posterior surface of the ulna and to the interosseous ligament; inferiorly to the posterior part of the superior extremity of the second and third phalanges of the indicator. *Relations*.—Posteriorly with the ulnaris externus, extensor proprius minimi digiti, and extensor communis digitorum muscles; anteriorly with the ulna, interosseous ligament, the extensor major pollicis manus muscle, and with the inferior extremity of the radius. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Tendinous at its lower insertion, fleshy at its upper part. *Use*.—It extends the index finger.

## 5. RADIAL REGION.

### *Supinator Radii Longus.*

*Situation*.—At the anterior and external part of the fore-arm. *Figure*.—Elongated; superiorly, flattened transversely; and inferiorly, from before backward. *Attachment*.—Superiorly to the inferior part of the external edge of the humerus and to the external inter-muscular aponeurosis; inferiorly to the anterior border of the radius, near the base of the styloid pro-

cess. *Relations*.—Anteriorly with the skin and anti-brachial aponeurosis; posteriorly with the supinator radii brevis, radialis externus longior, pronator teres, radialis internus, flexor superficialis digitorum, and flexor longus pollicis manus muscles, and the radial artery and nerve; on the inner side with the brachialis internus muscle. *Direction*.—Vertical. *Structure*.—Tendinous in its lower third, fleshy in other parts. *Use*.—It brings the hand to supination, and flexes the fore-arm.

### *Supinator Radii Brevis.*

*Situation*.—At the superior, external, and posterior part of the fore-arm. *Figure*.—Triangular, short, flat, and curved on itself from without inward. *Attachment*.—By one part to the external condyle of the humerus, and to a small portion of the posterior face of the ulna; by the other to the superior third of the posterior and external surfaces of the radius. *Relations*.—On the outer side, anteriorly and posteriorly, with the pronator teres and supinator radii longus muscles, the radial vessels and nerves, the radialis externus longior et brevior, extensor communis digitorum, extensor proprius minimi digiti, ulnaris externus and anconeus muscles; on the inner side with the external part of the articulation of the humerus with the ulna, and with the superior articulation of the radius with the same; with the ulna, interosseous ligament, and radius. *Direction*.—The fibres are oblique from above downward, from within outward, and from behind forward. *Structure*.—Tendinous at its insertion in the humerus, fleshy in other parts. *Use*.—It brings the fore-arm into supination.

### *Radialis Externus Longior.*

*Situation*.—At the external part of the fore-arm. *Figure*.—Elongated and flattened. *Attachment*.—Superiorly to the inferior part of the external edge of the humerus, and to the superior part of the external condyle; inferiorly to the postero-external part of

the upper extremity of the second metacarpal bone. *Relations*.—Anteriorly with the aponeurosis of the fore-arm, with the supinator radii longus, abductor longus et extensor brevis pollicis manus muscles; posteriorly with the articulation of the humerus with the ulna, with the supinator radii brevis, and radialis externus brevior muscles. *Direction*.—A little oblique from above downward and from before backward. *Structure*.—Tendinous at its lower extremity, fleshy in other parts. *Use*.—It brings the hand to a state of supination, and extends it on the fore-arm, or this on the hand.

### *Radialis Externus Brevior.*

*Situation*.—At the postero-external part of the fore-arm. *Figure*.—Elongated and flattened. *Attachment*.—Superiorly to the external condyle of the humerus; inferiorly to the posterior and external part of the upper extremity of the third metacarpal bone. *Relations*.—On the outer side with the former, and supinator radii longus, abductor longus, and extensor brevis pollicis manus muscles, and with the tendon of the extensor major pollicis manus; on the inner side with the supinator radii brevis, pronator teres, with the radius, and articulations of the wrist. *Direction*.—A little oblique from above downward and from before backward. *Structure*.—Tendinous at its extremity, fleshy in other parts. *Use*.—Same as preceding.

## MUSCLES OF THE HAND.

The hand embraces three muscular regions.

### 1. EXTERNAL PALMAR REGION.

*Abductores Brevis Pollicis Manus, Interior et Exterior.*

*Situation*.—In the thenar eminence. *Figure*.—Short, thick, triangular. *Attachment*.—Superiorly to the upper and anterior part of the scaphoid bone, and

to the annular ligament of the carpus; inferiorly to the external side of the superior extremity of the first phalanx of the thumb. *Relations*.—On the outer side with the palmar aponeurosis and with the skin; posteriorly with the opponens and flexor brevis pollicis manus. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Tendinous below, aponeurotic above, fleshy in the centre. *Use*.—It removes the thumb from the index.

### *Opponens Pollicis.*

*Situation*.—In the thenar eminence. *Figure*.—Thick and triangular. *Attachment*.—Superiorly to the anterior annular ligament of the carpus, and to the anterior face of the os trapezium; inferiorly to the external part of the anterior face of the first metacarpal bone, and to its external border. *Relations*.—Anteriorly with the preceding muscle and with the skin; posteriorly with the anterior annular ligament of the carpus, the articulation of the os trapezium with the first metacarpal bone, with a part of the anterior face of this latter bone, and the flexor brevis pollicis manus muscle. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Aponeurotic at its attachments, fleshy elsewhere. *Use*.—It brings the thumb towards the hollow of the hand, and in opposition to the other fingers.

### *Flexor Brevis Pollicis Manus.*

*Situation*.—In the thenar eminence. *Figure*.—Elongated and thick. *Attachment*.—Superiorly to the antero-inferior part of the annular ligament of the carpus, to the os magnum, to the antero-superior part of the third metacarpal bone; inferiorly to the anterior part of the superior extremity of the first phalanx of the thumb, and to the two sesamoid bones found at the articulation of the metacarpal bone with the phalanx of the thumb. *Relations*.—Anteriorly with the tendon of the flexor longus pollicis manus, with the tendons of the flexor profundus digitorum, the two

first lumbricales muscles, an aponeurosis, the skin, and adductor minimi digiti muscle; posteriorly with the first metacarpal bone, the two first dorsal interosseous muscles, and the first palmar, and the tendon of the radialis internus muscle. *Direction*.—Oblique from above downward and from within outward. *Structure*.—Tendinous at its extremities, fleshy at the centre. *Use*.—It flexes the first phalanx of the thumb.

### *Adductor Pollicis Manus.*

*Situation*.—In the thenar eminence, under the preceding. *Figure*.—Broad, thin, and triangular. *Attachment*.—On the inner side to the inferior three fourths of the anterior surface of the third metacarpal bone; on the outer side to the inner side of the superior extremity of the first phalanx of the thumb. *Relations*.—Anteriorly with the tendons of the flexor profundus, the first two lumbricales muscles, and with the skin; posteriorly with the first three interosseous muscles and skin. *Direction*.—Transverse. *Structure*.—Tendinous at its base and summit, fleshy in the rest of its extent. *Use*.—It approximates the thumb to the other fingers.

## 2. INTERNAL PALMAR REGION.

### *Palmaris Brevis.*

*Situation*.—In front of the hypo-thenar eminence. *Figure*.—Quadrilateral, very thin. *Attachment*.—On the outer side to the anterior annular ligament of the carpus, and to the palmar aponeurosis; on the inner side to the inner face of the skin. *Relations*.—Anteriorly with the skin; posteriorly with the adductor and flexor minimi digiti, ulnar artery, and nerve. *Direction*.—Transverse. *Structure*.—Fleshy, except at its attachment to the annular ligament. *Use*.—It enlarges the concavity of the palm of the hand.

*Adductor Minimi Digiti.*

*Situation.*—In the hypo-thenar eminence. *Figure.*—Elongated, flattened, broader in its middle portion than at its extremities. *Attachment.*—Superiorly to the anterior and inferior parts of the os pisiforme; inferiorly to the internal side of the superior extremity of the first phalanx of the little finger. *Relations.*—Anteriorly with the palmaris brevis, a very thin aponeurosis, and the skin; posteriorly with the adductor ossis metacarpi digiti minimi. *Direction.*—Vertical. *Structure.*—Aponeurotic at its extremities, fleshy in other parts. *Use.*—It separates the little finger from the rest, and slightly flexes it.

*Flexor Proprius Digiti Minimi.*

*Situation.*—In the hypo-thenar eminence. *Figure.*—Elongated, thin, and narrow. *Attachment.*—Superiorly to the anterior annular ligament of the carpus and to the anterior border of the process of the unciform bone; inferiorly to the internal side of the superior extremity of the first phalanx of the little finger. *Direction.*—A little oblique from above downward and from without inward. *Structure.*—Tendinous at its extremities, and fleshy in other parts. *Use.*—It flexes the little finger.

*Adductor Ossis Metacarpi Digiti Minimi.*

*Situation.*—In the hypo-thenar eminence. *Figure.*—Triangular. *Attachment.*—Superiorly to the anterior annular ligament of the carpus, and to the process of the os unciforme; inferiorly to the internal border of the fifth metacarpal bone. *Relations.*—Anteriorly with the adductor and flexor brevis digiti minimi muscles, and with the aponeurotic expansion of the tendon of the ulnaris externus; posteriorly with the last interosseous muscle, the fifth metacarpal bone, and the tendon of the superficial flexor which goes to the little finger. *Direction.*—Oblique from above downward and from without inward. *Structure.*—Tendinous at

its attachments, fleshy in its centre. *Use*.—It brings the fifth metacarpal bone forward and outward.

### 3. MIDDLE PALMAR REGION.

#### *Lumbricales.*

*Number*.—Four in each hand. *Situation*.—In the palm of the hand. *Figure*.—Small, rounded, elongated, and fusiform. *Attachment*.—Anteriorly, the first to the antero-external part of the tendon of the flexor profundus which goes to the indicator; the three others to the separation of the other tendons of the same name; inferiorly to the postero-external side of the superior extremity of the first phalanges of the four last fingers. *Relations*.—Anteriorly with the tendons of the flexor sublimis, palmar aponeurosis, vessels and nerves of the fingers; posteriorly with the interosseous muscles, inferior transverse metacarpal ligament, and the phalanges. *Direction*.—The first obliquely downward and outward; the fourth obliquely downward and inward; the two others vertical. *Structure*.—Tendinous at their lower insertion, fleshy in other parts. *Use*.—They flex the first phalanx of the fingers.

#### *Interossei Interni et Externi.*

*Number*.—Seven in each hand, two for each of the three middle fingers, and one for the small one. *Situation*.—In the intervals of the metacarpal bones; four in the back of the hand, and three in the palm; divided into the adductors and abductors. *Structure*.—Terminating inferiorly by a small tendon.

#### *Abductor Indicis.*

*Situation*.—Between the first and second metacarpal bones. *Figure*.—Triangular. *Attachment*.—Superiorly to the upper half of the inner side of the first metacarpal bone, and to the outer side of the second; inferiorly to the outer side of the upper extremity of the first phalanx of the index finger. *Relations*.—



Posteriorly with the skin; anteriorly with the first lumbricalis muscle, the flexor pollicis brevis, and the adductor pollicis. *Direction*.—A little oblique from above downward and from without inward.

*Adductor Indicis.*

*Situation*.—Between the second and third metacarpal bones, in the palm of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the anterior part of the inner face of the second metacarpal bone; inferiorly to the inner side of the upper extremity of the first phalanx of the index finger. *Relations*.—Anteriorly with the flexor pollicis brevis and the adductor pollicis; on the inside with the next muscle. *Direction*.—Vertical. *Use*.—It separates the index finger from the thumb, and approximates it to the middle finger.

*Abductor Digiti Tertii.*

This is the second dorsal interosseous muscle. *Situation*.—Between the second and third metacarpal bones, in the back of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the posterior part of the inner face of the second metacarpal bone, and to all the external face of the third; inferiorly to the outer side of the upper extremity of the first phalanx of the middle finger. *Relations*.—Posteriorly with the skin and the tendons of the extensor muscles of the index finger; anteriorly with the flexor pollicis brevis and the adductor pollicis proprius. *Direction*.—Vertical.

*Adductor Digiti Tertii.*

The third dorsal interosseous muscle. *Situation*.—Between the third and fourth metacarpal bones, in the back of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the posterior part of the external face of the fourth metacarpal bone, and to all the inner face of the third; inferiorly to the

inner side of the upper extremity of the first phalanx of the middle finger. *Relations*.—Posteriorly with the skin and tendons of the extensor digitorum communis; anteriorly with the second palmar interosseous muscle.

*Abductor Digiti Annularis.*

The second palmar interosseous muscle. *Situation*.—Between the third and fourth metacarpal bones, in the palm of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the anterior part of the external face of the fourth metacarpal bone, and to the entire length of the metacarpus; inferiorly to the outer side of the upper extremity of the first phalanx of the ring finger. *Relations*.—Anteriorly with the lumbricales muscles, and the tendons of the flexor profundus; posteriorly with the third dorsal interosseous muscle. *Direction*.—Vertical.

*Adductor Digiti Annularis.*

The fourth dorsal interosseous muscle. *Situation*.—Between the fourth and fifth metacarpal bones in the back of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the posterior part of the fifth metacarpal bone, and to the whole inner face of the fourth; inferiorly to the inner side of the upper extremity of the first phalanx of the ring finger. *Relations*.—Posteriorly with an aponeurosis which goes from the fourth to the fifth bones of the metacarpus, with the extensor tendons of the little finger, and the skin; anteriorly with the third palmar interosseous muscle. *Direction*.—Vertical.

*Abductor Minimi Digiti.*

The third palmar interosseous muscle. *Situation*.—Between the fourth and fifth metacarpal bones, in the palm of the hand. *Figure*.—Prismatic and triangular. *Attachment*.—Superiorly to the anterior part of the external face of the fifth metacarpal bone;

inferiorly to the outer side of the upper extremity of the first phalanx of the little finger. *Relations*.—Anteriorly with the opponens minimi digiti muscle, on the outside with the fourth dorsal interosseous muscle. *Direction*.—Vertical.

## APONEUROSES AND ANNULAR LIGAMENTS OF THE SUPERIOR EXTREMITIES.

### *Brachial Aponeurosis.*

Very thin, transparent, and cellular in different points; arising gradually from the tendons of the pectoralis major, latissimus dorsi, and that of the deltoid; enveloping most of the arm; it is attached inferiorly to the internal and external condyles of the humerus, and is continuous before and behind the articulation of the humerus and ulna with the anti-brachial aponeurosis.

### *Anti-Brachial Aponeurosis.*

Superiorly this is continuous with the preceding; receiving a portion of the expansion of the tendon of the biceps, some fibrous fasciculi attached to the condyle and epitrochlea, and a prolongation of the tendon of the triceps brachialis muscle; it envelops all the superficial muscles of the fore-arm, which are attached to it by septa; it is inserted on the inner side to the internal border of the ulna, is continuous inferiorly with the annular ligaments of the carpus, and is formed of fibres frequently decussating.

### *Anterior Annular Ligament of the Carpus.*

*Situation*.—In front of the carpus. *Figure*.—Quadrilateral, broader transversely than from above downward, forming a canal in uniting with the carpus. *Attachment*.—On the outer side to the anterior part of the trapezium and scaphoid bone, the point where it gives attachment to most of the muscles of the thumb; on the inner side to the os pisiforme and process of the os unciforme. *Relations*.—Anteriorly

with the tendon of the palmaris longus, palmaris brevis, ulnar vessels, and skin; posteriorly with the tendons of the flexors of the fingers, radialis internus, and flexor longus pollicis manus, and median nerve. *Structure*.—Formed of close transverse fibres.

*Posterior Annular Ligament of the Carpus.*

*Situation*.—At the posterior part of the articulation of the carpus. *Attachment*.—On the outer side to the infero-external part of the radius; on the inner side to the infero-internal side of the ulna. *Relations*.—Posteriorly with the skin, anteriorly with the fibrous sheaths of most of the tendons of the extensor muscles of the hand and fingers. *Structure*.—Formed of parallel transverse and very compact white fibres.

*Palmar Aponeurosis.*

Triangular, broader inferiorly than superiorly, arising superiorly from the anterior annular ligament of the carpus and from the inferior part of the anti-brachial aponeurosis; terminating inferiorly in bifurcations, which are lost in the ligaments of the articulations of the metacarpus with the phalanges of the fingers; giving off laterally two prolongations, which cover the muscles of the thumb and of the little finger; in relation anteriorly with the skin, posteriorly with the tendons of the flexor muscles, lumbricales, palmar vessels, and nerves. *Structure*.—Formed of close, strong fibres.

## MUSCLES OF THE INFERIOR EXTREMITIES.

### MUSCLES OF THE THIGH.

The thigh is divided into six muscular regions.

#### 1. GLUTEAL REGION.

##### *Glutæus Maximus.*

*Situation*.—At the posterior part of the trunk and at the supero-posterior part of the thigh. *Figure*.—

Quadrilateral, broad, and thick. *Attachment*.—Superiorly to the posterior fifth of the external border of the crest of the ilium, to that part of the bone comprised between this crest and the superior curved line, to the posterior surface of the sacrum, to the border of the os coccygis, and to the posterior face of the great sacro-sciatic ligament; inferiorly to a rough impression extending from the base of the great trochanter of the femur to the linea aspera, and to the superior part of this line, between the third adductor and triceps muscles. *Relations*.—Posteriorly with a layer of the fascia lata and with the skin; anteriorly with the os ilium, sacrum, os coccygis, origin of the lumbo-costalis muscle, the glutæus medius, pyramidalis, gemelli, obturator internus, and quadratus femoris muscles; with the sciatic nerve, sciatic tuberosity, posterior sacro-sciatic ligament, superior extremity of the biceps, and semi-tendinosus, with the great trochanter, adductor muscles, and triceps cruris. *Direction*.—The fibres pass obliquely from above downward, from behind forward, and from within outward. *Structure*.—Aponeurotic at its superior attachment, terminating inferiorly by a broad, thick tendon, with a synovial bursa on the internal surface of the tendon.

### *Glutæus Medius.*

*Situation*.—At the postero-external part of the pelvis. *Figure*.—Triangular, broad, thick, and radiating. *Attachment*.—Superiorly to the three anterior fourths of the crest of the ilium, to that part of its external surface comprised between the three portions, to the superior and inferior curved line; inferiorly to the superior border of the great trochanter. *Relations*.—On the outer side with the crural aponeurosis and glutæus maximus; on the inside with the ilium, glutæus minimus, pyramidalis, triceps femoris, and glutæal artery. *Direction*.—The anterior fibres, oblique from above downward and from before backward; the middle, vertical; the posterior, oblique from above downward and from behind forward. *Structure*.—

Tendinous at its attachment to the great trochanter, fleshy in other parts.

*Glutæus Minimus.*

*Situation.*—At the posterior external part of the pelvis. *Figure.*—Triangular, broad, flat, and radiating. *Attachment.*—Superiorly to the external surface of the ilium, from the inferior curved line as far as the cotyloid cavity; inferiorly to the anterior side of the great trochanter. *Relations.* On the outer side with the glutæus medius, and a little with the pyramidalis; on the inner side with the ilium, the fibrous capsule of the articulation of the femur with the ilium, the curved tendon of the rectus femoris, and a little with the triceps cruris. *Direction.*—The anterior fibres, obliquely downward and backward; the middle, vertical; and the posterior, obliquely downward and forward. *Structure.*—Tendinous at its attachment to the great trochanter, fleshy in other parts.

*Use of the Glutæi muscles.*—The three glutæi muscles bring the thigh backward and outward, and rotate it outward. The glutæus maximus brings the pelvis forward, and also the coccyx to its side and forward. The glutæus medius tenses the fascia lata a little.

2. THE PELVI-TROCHANTERIAN REGION.

*Pyramidalis.*

*Situation.*—At the posterior part of the thigh and within the pelvis. *Figure.*—Triangular, flattened, and elongated. *Attachment.*—Superiorly by its base to the lateral part of the anterior surface of the sacrum, to the anterior surface of the great sacro-sciatic ligament, and to the supero-posterior part of the ilium; inferiorly by its summit to the digital cavity of the great trochanter. *Relations.*—Anteriorly with the rectum, sciatic plexus, hypogastric vessels, ilium, ilio-femoral capsule, and glutæus minimus; posteriorly with the sacrum and glutæus maximus; its su-

perior border corresponds on the inner side to the glutæal artery, and on the outer side to the glutæus medius and minimus; the inferior border corresponds to the anterior sacro-sciatic ligament, and is separated from the superior gemellus by the sciatic nerve. *Direction*.—Obliquely from above downward and from within outward. *Structure*.—Tendinous at its summit, fleshy elsewhere. *Use*.—It rotates the thigh outward, and exercises it slightly in the motion of adduction.

### *Obturator Internus.*

*Situation*.—Within the pelvis and at the supero-posterior part of the thigh. *Figure*.—Triangular, flat. *Attachment*.—Superiorly to the posterior surface of the pubis, at the supero-internal part of the obturator foramen, to the ligament of the same name; inferiorly to the digital cavity of the trochanter, between the tendons of the pyramidalis and obturator externus. *Relations*.—On the outer side with the pelvis, ilium, obturator ligament, sciatic nerve, and glutæus maximus; on the inner side with the aponeurosis to which the levator ani is attached, and with the capsule of the femoral joint. *Direction*.—In the pelvis, oblique from above downward, from before backward, and from without inward. *Structure*.—Tendinous at its attachment to the great trochanter, fleshy elsewhere. *Use*.—Same as that of the preceding muscle.

### *Obturator Externus.*

*Situation*.—At the superior and internal part of the thigh. *Figure*.—Triangular and flat. *Attachment*.—On the inner side to the anterior face of the body of the pubis, to that of the branch of the same bone, and of the ischium, and to the internal part of the anterior surface of the obturator ligament; on the outer side to the inferior part of the digital cavity of the trochanter, beneath the inferior gemellus. *Relations*.—Anteriorly with the pectineus, adductors, and quad-

ratus femoris muscle; posteriorly with the ilium, the obturator ligament, and capsule of the femoral joint. *Direction*.—Oblique from within outward and from above downward, and curved from below upward behind the neck of the femur. *Structure*.—Tendinous at its external insertion, fleshy in the rest of its extent.

### *Gemellus Superior.*

*Situation*.—At the posterior part of the pelvis. *Figure*.—Elongated, flattened, thicker in the middle than at the extremities. *Attachment*.—On the inner side to the external border of the sciatic spine; on the outer side to the superior part of the internal surface of the great trochanter. *Relations*.—Posteriorly with the sciatic nerve and glutæus maximus; on the inner side with the ilium and capsule of the femoral articulation. *Direction*.—Transverse. *Structure*.—Tendinous at its inner extremity.

### *Gemellus Inferior.*

It has the same form as the preceding. *Attachment*.—On the inner side to the supero-posterior part of the tuberosity of the ischium; on the outer side to the digital cavity of the great trochanter above the external obturator muscle. Its relations are the same as those of the preceding. *Use*.—The gemelli muscles and the obturator externus rotate the thigh outward, and give to it a slight motion of adduction.

### *Quadratus Femoris.*

*Situation*.—At the superior and posterior part of the thigh. *Figure*.—Square, flat, and thin. *Attachment*.—On the inner side to the external part of the tuberosity of the ischium; on the outer side to the inferior part of the posterior border of the great trochanter. *Relations*.—Posteriorly with the sciatic nerve and glutæus maximus, semi-membranosus, and great adductor; anteriorly with the external obtura-



tor muscle, the extremity of the tendon of the psoas major, and the posterior part of the lesser trochanter. *Direction*.—Transverse. *Structure*.—Fleshy in its body, aponeurotic at its insertions. *Use*.—It rotates the thigh outward, and gives to it slightly the motion of adduction.

### 3. ANTERIOR CRURAL REGION.

#### *Sartorius.*

*Situation*.—At the anterior part of the thigh. *Figure*.—Very long and flat. *Attachment*.—Superiorly to the antero-superior spinous process of the ilium, and to the superior half of the notch which is beneath; inferiorly to the internal side of the superior extremity of the tibia. *Relations*.—Anteriorly with the fascia lata; posteriorly, and from above downward, with the psoas and iliacus united, the rectus femoris, triceps cruris, the middle and great adductors, and the gracilis muscle, the crural artery, and internal lateral ligament of the articulation of the knee. *Direction*.—In its superior half, oblique from above downward, from without inward, and from before backward; and in the inferior half, oblique from behind forward and from within outward. *Structure*.—At its inferior extremity the tendon spreads out into a strong aponeurosis, which passes on the tendons of the semi-tendinosus and vastus internus muscles, and terminates in the front part of the tibia. *Use*.—It flexes the leg on the thigh, and the thigh on the pelvis, and gives to the lower limb the motion of adduction.

#### *Rectus Femoris.*

*Situation*.—At the anterior part of the thigh. *Figure*.—Elongated, flat, fusiform, broader in the middle than at the extremities. *Attachment*.—Superiorly to the antero-inferior spinous process of the ilium, and to the superior part of the border of the acetabulum; inferiorly to the superior border of the patella in junction with the triceps. *Relations*.—Anteriorly with the fascia lata, iliacus, and sartorius; posteriorly with

the ilio-femoral articulation, triceps cruris, and circumflex vessels. *Direction*.—Vertical. *Structure*.—Terminated superiorly by two tendons; below by a tendon which blends with that of the triceps, fleshy in other parts. *Use*.—It flexes the thigh on the pelvis, and extends the leg on the thigh.

*Vastus Externus et Internus.*

This muscle is divided into three fasciculi. Its external fasciculus, or *vastus externus*, is attached superiorly to the base and anterior part of the great trochanter, also to the external border of the linea aspera; its internal fasciculus, or *vastus internus*, is attached to the antero-inferior part of the base of the little trochanter, and to the internal border of the linea aspera; the *middle* fasciculus is attached superiorly to the anterior part of the base of the neck of the femur, and along the oblique line passing from the great to the little trochanter; also to the three superior fourths of the anterior surface of the body of the femur; inferiorly, these three portions, uniting, are attached to the base and borders of the patella, and to the internal and external tuberosities of the tibia, by two lateral fibrous expansions. *Relations*.—On the outer side with the tendons of the glutæus maximus and minimus, the fascia lata, tensor vaginæ femoris, short portion of the biceps; anteriorly with the iliacus and rectus femoris muscles; on the inner side with the fascia lata, femoral artery, and sartorius; posteriorly with the whole surface of the body of the femur. *Direction*.—The middle fibres are vertical; the internal are oblique from above downward, from behind forward, and from within outward; the external, oblique from above downward, from without inward, and from behind forward. *Structure*.—Tendinous at its attachment to the patella, fleshy elsewhere. *Use*.—It extends the leg on the thigh.

## 4. POSTERIOR CRURAL REGION.

*Semi-tendinosus.*

*Situation.*—At the posterior part of the thigh. *Figure.*—Elongated and flat, broader superiorly than inferiorly. *Attachment.*—Superiorly to the posterior part of the tuberosity of the ischium; inferiorly to the infero-internal part of the internal tuberosity of the tibia. *Relations.*—Posteriorly with the fascia lata, and a little with the glutæus maximus; anteriorly with the semi-membranosus and third adductor. *Direction.*—A little oblique from above downward and from without inward. *Structure.*—Tendinous in its lower third, fleshy in the rest of its extent. *Use.*—It flexes the leg or depresses the pelvis.

*Semi-membranosus.*

*Situation.*—At the posterior part of the thigh. *Figure.*—Thin, flattened superiorly, quadrilateral in the middle, and rounded inferiorly. *Attachment.*—Superiorly to the posterior part of the tuberosity of the ischium; inferiorly to the postero-internal side of the internal tuberosity of the tibia. *Relations.*—Posteriorly with the biceps and semi-tendinosus muscles, and the fascia lata; anteriorly with the quadratus femoris, third adductor, popliteal artery, and articulation of the knee joint; by its external border with the sciatic nerve; it concurs with the biceps to form the ham; the internal border is covered by the vastus internus and fascia lata. *Direction.*—Oblique from above downward and from without inward. *Structure.*—Aponeurotic in its upper third, tendinous at its lower insertion, fleshy in its centre. *Use.*—Same as that of the preceding muscle.

*Biceps Femoris.*

*Situation.*—At the posterior part of the thigh. *Figure.*—Elongated, flat, and divided superiorly into two portions, one long, the other short. *Attachment.*—

Superiorly by its long portion to the posterior and external part of the tuberosity of the ischium; by its short portion to a considerable part of the external border of the linea aspera of the femur; these two portions unite, and terminate inferiorly in the superior extremity of the fibula. *Relations*.—Posteriorly with the glutæus maximus and fascia lata; anteriorly with the semi-membranosus, triceps, and third adductor muscles, sciatic nerve, femur, and external lateral ligament of the knee. *Direction*.—A little oblique from above downward and from within outward. *Structure*.—Tendinous at its attachments, fleshy in other parts. *Use*.—It flexes the leg and turns it outward. It also tenses the crural aponeurosis. If the leg be fixed, it depresses the pelvis on the thigh.

#### 5. INTERNAL CRURAL REGION.

##### *Pectineus.*

*Situation*.—At the upper and anterior part of the thigh. *Figure*.—Triangular, flat, broader superiorly than inferiorly. *Attachment*.—Superiorly to the superior border of the pubis, between its spine and iliopectineal eminence; inferiorly to the line which descends from the little trochanter to the linea aspera of the femur. *Relations*.—Anteriorly with the fascia lata, femoral vessels, and nerves; posteriorly with the body of the pubis and ilio-femoral articulation, the external obturator and second adductor muscles, and the obturator vessels and nerves; its internal border is covered by the first adductor. *Direction*.—Obliquely downward, outward, and backward. *Use*.—It flexes the thigh, and carries it inward.

##### *Gracilis.*

*Situation*.—At the internal part of the thigh. *Figure*.—Elongated, flat, thin, broader superiorly than inferiorly. *Attachment*.—Superiorly to the anterior face of the body of the pubis near its symphysis, to the ramus of the pubis, and to that of the ischium; in-

feriorly to the supero-internal part of the internal tuberosity of the tibia. *Relations*.—On the inner side with the fascia lata and sartorius; on the outer side with the adductors and semi-membranosus muscle, and the internal lateral ligament of the articulation of the knee joint. *Direction*.—Vertical. *Structure*.—Tendinous at its lower third, aponeurotic at its upper extremity, fleshy at its centre. *Use*.—It flexes the leg on the thigh, and gives to the lower limb the motion of adduction.

### *Adductor Longus.*

*Situation*.—At the upper and inner part of the thigh. *Figure*.—Elongated, triangular, and flat, much broader inferiorly than superiorly. *Attachment*.—Superiorly to the anterior surface of the body, spine, and symphysis pubis; inferiorly to the middle part of the interstice in the linea aspera, between the vastus internus and third adductor, with which it is strongly united. *Relations*.—Anteriorly with the fascia lata, sartorius, and femoral artery; posteriorly with the other two adductor muscles. *Direction*.—Obliquely downward, outward, and backward. *Structure*.—Aponeurotic at its inferior attachment, where it concurs to form with the other adductors an aponeurotic opening for the passage of the femoral artery; tendinous at the superior attachment, and fleshy in other parts.

### *Adductor Brevis.*

*Situation*.—At the upper and inner part of the thigh. *Figure*.—Triangular and flat. *Attachment*.—Superiorly to the space which separates the symphysis pubis from the obturator foramen; inferiorly to the superior third of the interstice of the linea aspera. *Relations*.—Anteriorly with the preceding and pectineus muscles; posteriorly with the third adductor muscle; on the inner side with the gracilis muscle; on the outer side with the tendon of the psoas and iliacus, and with the obturator externus muscle. *Direction*.—Obliquely downward, outward, and backward.

*Structure*.—Aponeurotic at its extremities, and pierced by the perforating arteries. *Use*.—These two adductor muscles bring the thigh to adduction, and flex it a little on the pelvis. They also slightly rotate it outward.

### *Adductor Magnus.*

*Situation*.—At the posterior and internal part of the thigh. *Figure*.—Broad, thick, and triangular. *Attachment*.—Superiorly to the inferior part of the anterior face of the ramus of the pubes, to the anterior face of that of the ischium, and to the external border of its tuberosity; inferiorly to the rough impression descending from the great trochanter to the linea aspera, to the whole length of the interstice of this line, and to the tuberosity of the internal condyle of the femur. *Relations*.—Anteriorly with the two preceding muscles, the sartorius, and femoral artery; posteriorly with the semi-tendinosus, semi-membranosus, biceps, and glutæus maximus muscles, and sciatic nerve. *Direction*.—The superior fibres nearly transverse, the internal nearly vertical, the middle oblique from above downward and from within outward. *Structure*.—Aponeurotic at its attachments to the linea aspera, at the end of which it bifurcates, so that one portion terminates in a point between the vastus internus and the short branch of the biceps, while the other is directed towards the tendon which terminates the vasti muscles; between these two portions an interval exists, traversed by the femoral artery and vein, and representing a species of fibrous canal. *Use*.—It gives to the thigh the motion of adduction, and rotates it a little outward.

## 6. EXTERNAL CRURAL REGION.

### *Tensor Vaginæ Femoris.*

*Situation*.—At the upper and outer part of the thigh. *Figure*.—Elongated, flat, broader and thinner inferiorly than superiorly. *Attachment*.—Superiorly to the

external border of the antero-superior spinous process of the ilium; inferiorly between the two folds of the fascia lata, and by means of this fascia to the linea aspera of the femur. *Relations*.—On the outer side with the fascia lata; on the inner side with another aponeurotic plate, which separates it from the rectus femoris and vasti muscles. *Direction*.—A little oblique from above downward and from before backward. *Structure*.—Tendinous at its superior attachment, fleshy in other parts. *Use*.—It tenses the fascia lata aponeurosis, and contributes also to support the muscles of the thigh when they contract.

## MUSCLES OF THE LEG.

The leg is divided into four muscular regions.

### I. ANTERIOR TIBIAL REGION.

#### *Tibialis Anticus.*

*Situation*.—At the anterior part of the leg. *Figure*.—Elongated, triangular, flattened from within outward. *Attachment*.—Superiorly to the anterior part of the external tuberosity of the tibia, to the superior half of its external surface, and to the anterior surface of the interosseous ligament; inferiorly by two small tendons, one to the base of the first cuneiform bone, the other to the internal side of the posterior extremity of the first metatarsal bone. *Relations*.—Anteriorly with the aponeurosis of the tibia, with which it adheres superiorly, the annular ligament of the tarsus, and dorsal aponeurosis of the foot; on the inner side with the tibia; on the outer with the extensor communis digitorum pedis, extensor proprius pollicis pedis, anterior tibial vessels, and nerves. *Direction*.—A little oblique from above downward and from without inward. *Structure*.—Tendinous at its lower third, fleshy in its upper two thirds. *Use*.—It flexes the foot on the leg, and directs its inner edge inward.



*Extensor Proprius Pollicis Pedis.*

*Situation.*—At the anterior part of the leg. *Figure.*—Broad, elongated, flattened transversely, thicker in the middle than at the extremities. *Attachment.*—Superiorly to the anterior part of the middle third of the internal face of the fibula, and to the neighbouring part of the interosseous ligament; inferiorly to the superior part of the posterior extremity of the last phalanx of the great toe. *Relations.*—On the inner side with the preceding muscle, and anterior tibial vessels and nerves; on the outer side with the extensor communis digitorum pedis; its anterior border is concealed superiorly between the tibialis anticus and extensor digitorum pedis; the posterior border lies on the fibula, interosseous ligament, tibia, anterior tibial artery, articulation of the tibia and tarsus, and upon the dorsum of the foot and great toe. *Direction.*—A little oblique from above downward and from without inward. *Structure.*—Tendinous at its lower third, fleshy in other parts. *Use.*—It extends the great toe, and may flex the foot on the leg, contracting forcibly.

*Extensor Communis Digitorum Pedis.*

*Situation.*—At the anterior part of the leg. *Figure.*—Elongated, thin, flattened transversely, divided into four portions inferiorly. *Attachment.*—Superiorly to the external tuberosity of the tibia, and to the anterior part of the internal surface of the fibula; inferiorly to the superior part of the posterior extremity of the second and last phalanges of the last four toes. *Relations.*—Anteriorly with the tibial aponeurosis, the annular ligament of the tarsus, and with the skin; on the inner side with the tibialis anticus and extensor proprius pollicis pedis muscles; on the outer side with the peroneus longus superiorly, the peroneus brevis in the middle, and with the peroneus tertius inferiorly. *Direction.*—A little oblique from above downward and from without inward. *Structure.*—



Terminating inferiorly in four long tendons, fleshy superiorly. *Use*.—It extends the last four toes, and may contribute to flex the foot on the leg.

*Peroneus Tertius.*

*Situation*.—At the anterior and inferior part of the leg. *Figure*.—Elongated, thin, and flat. *Attachment*.—Superiorly to the inferior third of the anterior border of the fibula, and to the neighbouring part of its internal surface; inferiorly to the external side of the posterior extremity of the fifth metatarsal bone. *Relations*.—On the outer side with the tibial aponeurosis; on the inner side with the extensor communis digitorum muscle; it covers, in the foot, the extensor brevis digitorum pedis, and the first metatarsal bone; its posterior border is applied on the fibula and interosseous ligament. *Direction*.—Oblique from above downward, from within outward, and from behind forward. *Structure*.—Tendinous below, fleshy above. *Use*.—It flexes the foot, and carries it outward.

## 2. SUPERFICIAL POSTERIOR TIBIAL REGION.

*Gastrocnemius Externus et Internus.*

*Situation*.—At the posterior part of the leg. *Figure*.—Elongated, thick, flattened from before backward, separated superiorly, united inferiorly. *Attachment*.—The external, superiorly to the upper and posterior part of the external condyle of the femur; the internal to the upper and posterior part of the internal condyle; inferiorly to the inferior part of the posterior surface of the calcaneum. *Relations*.—Posteriorly with the skin; anteriorly with the condyles of the femur, the synovial membrane of the articulation of the tibia with the femur; the external portion with the popliteus, the internal with the semi-membranosus muscle, with the popliteal artery, plantaris, and soleus muscles. *Direction*.—Vertical. *Structure*.—Tendinous at their extremities, fleshy in the centre.

*Use.*—They extend the foot on the leg, and may flex the leg on the thigh.

### *Soleus.*

*Situation.*—At the posterior part of the leg. *Figure.*—Broad, thick, flattened from before backward, oval. *Attachment.*—Superiorly to the posterior side of the upper extremity of the fibula, to the upper third of its posterior surface, to the oblique line on the posterior face of the tibia, and to a portion of its inner edge; inferiorly to the inferior part of the posterior face of the calcaneum; intimately united inferiorly with the tendon of the former muscle, and concurring thus to form the tendo achillis. *Relations.*—Posteriorly with the preceding muscles, the plantaris and tibial aponeurosis; anteriorly with the peroneus longus et brevis, popliteus, flexor communis digitorum pedis, flexor proprius pollicis pedis, and tibialis posticus muscles, a part of the posterior surface of the tibia, the popliteal, posterior tibial, and peroneal vessels. *Direction.*—Vertical. *Structure.*—Aponeurotic at its upper insertions, terminated inferiorly by a tendon, which unites with that of the gastrocnemii muscles, and forms the *tendo achillis*, fleshy and aponeurotic at its centre. *Use.*—It extends the foot on the leg.

### *Plantaris.*

*Situation.*—At the lower and posterior part of the thigh. *Figure.*—Elongated, thin, and narrow. *Attachment.*—Superiorly to the posterior part of the external condyle of the femur, to the posterior ligament of the articulation of the knee joint, and to the tendon of the gastrocnemius externus; inferiorly to the internal side of the tendo achillis, accompanying it to the calcaneum. *Relations.*—Posteriorly with the gastrocnemii muscles and skin; anteriorly with the articulation of the knee joint, popliteal vessels, and popliteus muscle, and lying on the soleus. *Direction.*—Obliquely downward and inward. *Structure.*—Tendi-

nous in its lower four fifths, fleshy in its upper fifth.  
*Use.*—It contributes to extend the foot on the leg.

### *Popliteus.*

*Situation.*—At the upper and posterior part of the leg, behind the knee. *Figure.*—Short, flat, and triangular. *Attachment.*—Superiorly to the depression observed on the tuberosity of the external condyle of the femur; inferiorly to the postero-superior triangular surface of the tibia, and to the oblique line on its posterior face. *Relations.*—Posteriorly with the gastrocnemii muscles, the plantaris, and popliteal vessels; anteriorly with the articulation of the tibia with the fibula, with the tibialis posticus, and the tibia itself; its external border is united by a thin membrane to the superior part of the fibula and to the soleus muscle. *Direction.*—Oblique from above downward and from without inward. *Structure.*—Tendinous at its upper insertion, aponeurotic at its posterior face, fleshy in the rest of its extent. *Use.*—It contributes to bend the leg, and rotates it inward when it is flexed.

## 3. DEEP POSTERIOR TIBIAL REGION.

### *Flexor Longus Communis Digitorum Pedis.*

*Situation.*—At the posterior part of the leg. *Figure.*—Elongated, flat, broader in its middle portion than at its extremities, divided into four portions inferiorly. *Attachment.*—Superiorly to the posterior face of the tibia, from the superior oblique line as far as its inferior fourth; inferiorly to the posterior part of the inferior face of the third phalanx of the four last toes. *Relations.*—In the leg, posteriorly with the soleus, tibial aponeurosis, and posterior tibial artery; anteriorly with the tibia, and tibialis posticus muscle; in the foot, inferiorly with the adductor proprius pollicis pedis, flexor brevis digitorum pedis, the abductor proprius pollicis pedis muscle, and plantar nerve; superiorly with the deep-seated muscles

of the sole of the foot. *Direction*.—Vertical in the leg, horizontal in the foot. The tendon of this muscle passes behind the internal malleolus, in a groove common to it with the tibialis posticus. *Structure*.—It terminates inferiorly by four tendons situated in the fibrous sheaths of the toes; it is fleshy superiorly. *Use*.—It flexes the three phalanges of the toes.

### *Tibialis Posticus.*

*Situation*.—At the posterior part of the leg. *Figure*.—Elongated, flat, thicker superiorly than inferiorly, in some degree prismatic and triangular. *Attachment*.—Superiorly to the postero-internal part of the fibula, to the superior part of the posterior surface of the tibia, to the posterior surface of the interosseous ligament; inferiorly to the tuberosity of the internal inferior part of the os naviculare. *Relations*.—Anteriorly with the fibula, the tibia, the interosseous ligament, and the inferior ligament of the articulation of the calcaneum with the os naviculare; posteriorly with the soleus, the flexor communis digitorum pedis, and the flexor proprius pollicis pedis muscles. *Direction*.—Vertical. *Structure*.—Aponeurotic at its superior attachment; its superior portion is bifurcated for the passage of the anterior tibial vessels; tendinous at its lower portion, and fleshy in other parts. *Use*.—It extends the foot and turns it inward.

### *Flexor Proprius Pollicis Pedis.*

*Situation*.—At the posterior part of the leg. *Figure*.—Elongated, thin, flattened superiorly, triangular inferiorly. *Attachment*.—Superiorly to the two inferior thirds of the posterior face of the fibula, to the infero-external part of the posterior surface of the interosseous ligament; inferiorly to the posterior part of the inferior face of the last phalanx of the great toe. *Relations*.—Posteriorly with the soleus muscle and tibial aponeurosis; anteriorly with the fibula, the tibialis posticus, and flexor communis digitorum pedis muscles, the interosseous ligament, and

with the tibia. *Direction*.—Vertical in the leg, horizontal in the foot. *Structure*.—Tendinous at its lower extremity, and fleshy superiorly. *Use*.—It flexes the great toe.

#### 4. PERONEAL REGION.

##### *Peroneus Longus.*

*Situation*.—At the external part of the leg. *Figure*.—Long, thick, nearly triangular superiorly; thin, narrow, and flattened inferiorly. *Attachment*.—Superiorly to the outer side of the upper extremity of the fibula, to the upper third of its external surface, and to the aponeurotic septa placed between it and the soleus and flexor longus pollicis pedis muscles on one side, and the extensor communis digitorum pedis on the other; inferiorly to the infero-external part of the posterior extremity of the first metatarsal bone. *Relations*.—On the outer side with the tibial aponeurosis; on the inner side with the fibula, the extensor communis digitorum pedis, and peroneus brevis; posteriorly with the soleus and flexor longus pollicis pedis. *Direction*.—Oblique from above downward and from before backward as far as the external border of the foot, and from behind forward and from without inward in the rest of its course. *Structure*.—Tendinous in its lower third, aponeurotic at its upper attachments, fleshy in the rest of its course. *Use*.—It extends the foot and turns it outward.

##### *Peroneus Brevis.*

*Situation*.—At the external part of the leg. *Figure*.—Elongated, flat, broader and thicker in the middle than at its extremities. *Attachment*.—Superiorly to the inferior half of the external face of the fibula, and to the intermuscular aponeuroses which separate it, anteriorly from the peroneus tertius and extensor communis digitorum pedis, and posteriorly from the flexor communis digitorum pedis muscles; inferiorly to the superior part of the posterior extremity of the

fifth metatarsal bone. *Relations*.—On the outer side with the peroneus longus and tibial aponeurosis; on the inner side with the fibula and extensor communis digitorum pedis, peroneus tertius, and flexor longus pollicis pedis muscles. *Direction*.—A little oblique from above downward and from before backward. *Structure*.—Tendinous at its lower third, fleshy in its upper two thirds. *Use*.—It turns the foot outward, and extends it a little on the leg.

## MUSCLES OF THE FOOT.

The foot comprises five muscular regions.

### 1. DORSAL REGION.

#### *Extensor Brevis Digitorum Pedis.*

*Situation*.—On the dorsum of the foot. *Figure*.—Flat, broad, and thin, divided into four portions anteriorly. *Attachment*.—Posteriorly to the anterior part of the external surface of the calcaneum, to the external ligament of the articulation of the calcaneum with the astragalus, and to the annular ligament of the tarsus; anteriorly to the superior part of the posterior extremity of the first phalanx of the great toe, and to the second and third phalanges of the three following toes. *Relations*.—Superiorly with a thin aponeurotic fold, and with the tendons of the extensor longus communis digitorum pedis muscle; inferiorly with the tarsus, metatarsus, dorsal interosseous muscles, and with the phalanges. *Direction*.—Oblique from behind forward and from without inward. *Structure*.—Terminated anteriorly by four tendons, aponeurotic at its posterior attachment, fleshy in the rest of its extent. *Use*.—It extends the first four toes.

### 2. MIDDLE PLANTAR REGION.

#### *Flexor Brevis Digitorum Pedis.*

*Situation*.—In the middle part of the sole of the foot. *Figure*.—Elongated, flat, thicker posteriorly

than anteriorly, divided in this latter direction into four portions. *Attachment*.—Posteriorly to the posterior part of the inferior face of the calcaneum; anteriorly to the middle part of the inferior face of the second phalanges of the last four toes. *Relations*.—Inferiorly with the plantar aponeurosis; superiorly with the lumbricales muscles, massa carnea sylvii, the plantar vessels and nerves, and with the tendons of the flexor communis. *Direction*.—Horizontal. *Structure*.—Terminated anteriorly by four tendons, aponeurotic posteriorly, fleshy in other parts. *Use*.—It flexes the first two phalanges of the last four toes.

### *Massa Carnea Sylvii.*

*Situation*.—At the posterior part of the sole of the foot. *Figure*.—Flat, thin, quadrilateral. *Attachment*.—Posteriorly to the posterior, inferior, and inner part of the calcaneum; anteriorly to the superior surface and external border of the tendon of the flexor longus digitorum pedis. *Relations*.—Inferiorly with the adductor proprius pollicis pedis, flexor brevis digitorum pedis, and abductor digiti minimi pedis muscles, and plantar vessels and nerves; superiorly with the calcaneum, the superficial inferior ligament of the articulation of the calcaneum with the os cuboides, and with the abductor minimi digiti pedis muscle. *Direction*.—Oblique from behind forward and from without inward. *Structure*.—Tendinous at its anterior and posterior edges, fleshy in the rest of its course. *Use*.—It increases the force of the flexor communis longus digitorum pedis.

### *Lumbricales.*

*Number*.—Four on each side. *Situation*.—At the anterior part of the sole of the foot. *Figure*.—Long, thin, and narrow. *Attachment*.—Posteriorly to the tendons of the flexor communis digitorum pedis; anteriorly to the internal side of the base of the first phalanx of the four last toes. *Relations*.—Inferiorly with the plantar aponeurosis; superiorly with the ab-

ductor proprius pollicis pedis and transversus pedis, and with the plantar interosseous muscles. *Direction*.—Horizontal. *Structure*.—Tendinous at their extremities, fleshy in the centre. *Use*.—They flex the first phalanx of the toes.

### 3. INTERNAL PLANTAR REGION.

#### *Adductor Proprius Pollicis Pedis.*

*Situation*.—At the inner part of the sole of the foot. *Figure*.—Elongated, flat, broader posteriorly than anteriorly. *Attachment*.—Posteriorly to the posterior, inferior, and internal part of the calcaneum, to an aponeurotic septum, and to the internal annular ligament of the tarsus; anteriorly to the infero-internal part of the posterior extremity of the first phalanx of the great toe. *Relations*.—Inferiorly with the plantar aponeurosis; superiorly with the massa carnea sylvii, the flexor brevis pollicis pedis, the tendons of the flexor longus digitorum pedis, of the tibialis anticus and posticus, and with the plantar vessels and nerves. *Direction*.—A little oblique from behind forward and from without inward. *Structure*.—Aponeurotic at its posterior insertion, tendinous at the anterior, fleshy in the rest of its extent. *Use*.—It approximates the great toe to the others, and slightly flexes it.

#### *Flexor Brevis Pollicis Pedis.*

*Situation*.—At the antero-internal part of the sole of the foot. *Figure*.—Short, thin, and narrow posteriorly, broad, thick, and bifurcated anteriorly. *Attachment*.—Posteriorly to the antero-inferior part of the calcaneum and to the two last cuneiform bones; anteriorly to the inferior lateral part of the base of the first phalanx of the great toe, and to the two sesamoid bones of the articulation of the phalanx of the same toe with the metatarsus. *Relations*.—Inferiorly with the flexor proprius pollicis pedis, the plantar aponeurosis, and the adductor pollicis pedis muscle; superiorly with the tendon of the peroneus longus



and with the first metatarsal bone. *Direction*.—A little oblique from behind forward and from without inward. *Structure*.—Tendinous at its attachments, fleshy at its centre. *Use*.—It flexes the first phalanx of the great toe.

*Abductor Pollicis Pedis.*

*Situation*.—At the anterior and middle part of the sole of the foot. *Figure*.—Triangular. *Attachment*.—Posteriorly to the inferior surface of the cuboid bone, to the sheath of the peroneus longus, and to the posterior extremity of the third and fourth metatarsal bones; anteriorly to the inferior and external part of the base of the first phalanx of the great toe, and to the external sesamoid bone of the articulation of the phalanx of the same toe with the metatarsus. *Relations*.—Inferiorly with the flexor communis digitorum pedis, massa carnea sylvii, the lumbricales muscles, and with the plantar aponeurosis; on the inner side with the flexor brevis pollicis pedis, the tendon of the peroneus longus, and external side of the metatarsal bone; on the outer side with the interosseous muscles and external plantar artery. *Direction*.—Oblique from behind forward and from without inward. *Structure*.—Tendinous at its extremities, fleshy at the centre. *Use*.—It separates the great toe from the others.

*Transversus Pedis.*

*Situation*.—At the anterior part of the sole of the foot, extending transversely beneath the heads of the last four metatarsal bones. *Figure*.—Flat, thin, and narrow. *Attachment*.—On the outer side to the ligaments of the last four articulations of the phalanges of the toes with the metatarsus; on the inner side to the external border of the first phalanx of the great toe. *Relations*.—Inferiorly with the tendons of the long and short flexors of the toes, the lumbricales muscles, the collateral vessels, and nerves of the toes; superiorly with the interosseous muscles. *Di-*

*rection*.—Transverse. *Structure*.—Fleshy. *Use*.—It approximates the first and fifth toe.

#### 4. EXTERNAL PLANTAR REGION.

##### *Abductor Minimi Digiti Pedis.*

*Situation*.—At the external part of the sole of the foot. *Figure*.—Elongated, flat, broader posteriorly than anteriorly. *Attachment*.—Posteriorly to the posterior and external part of the inferior surface of the calcaneum; anteriorly to the external side of the base of the first phalanx of the little toe, and to the inferior and external side of the posterior extremity of the fifth metatarsal bone. *Relations*.—Inferiorly with the plantar aponeurosis; superiorly with the massa carnea sylvii, the inferior calcaneo-cuboidean ligament, the tendon of the peroneus longus, the posterior extremity of the fifth metatarsal bone, and with the flexor brevis digiti minimi pedis. *Direction*.—Oblique from behind forward and from within outward. *Structure*.—Tendinous at its anterior attachment, aponeurotic at the posterior, fleshy in other parts. *Use*.—It separates the little toe from the others.

##### *Flexor Brevis Digiti Minimi Pedis.*

*Situation*.—At the anterior and external part of the sole of the foot. *Figure*.—Elongated, thick in its middle portion, thin at its extremities. *Attachment*.—Posteriorly to the inferior part of the posterior extremity of the fifth metatarsal bone, and to the fibrous sheath of the tendon of the peroneus longus; anteriorly to the inferior and external side of the posterior extremity of the first phalanx of the little toe. *Relations*.—Inferiorly with the plantar aponeurosis and preceding muscle; superiorly with the fifth metatarsal bone and last plantar interosseous muscle. *Direction*.—Horizontal. *Structure*.—Tendinous at its insertion, fleshy in the centre. *Use*.—It flexes the little toe.

## 5. INTEROSSEOUS REGION.

*Interossei Externi et Interni.*

*Number.*—Seven on each side, two for each of the three middle toes, and one for the small one. *Situation.*—Their situation, form, and disposition are similar to those of the hand; they are distinguished into adductors and abductors, three situated in the sole of the foot, and four on the dorsum.

## APONEUROSES AND ANNULAR LIGAMENTS OF THE INFERIOR EXTREMITIES.

*Fascia Lata.*

This is continuous, superiorly and anteriorly, with the fibres of the crural arch; it is attached posteriorly, by a few delicate fibres, to the sacrum and os coccygis; it is inserted, on the outer side, into the external border of the crest of the ilium, is continuous on the inner side with the ligaments of the symphysis pubis, and is inserted in the periosteum; at the inferior part of the thigh it is confounded with the tibial aponeurosis. Superiorly we observe a considerable opening placed in front of the pectineus muscle, beneath the crural arch, and traversed by the saphena vein. This opening is formed in the following manner: the fascia lata being composed of two portions, the *iliac* and the *pubic*, the former is folded in the shape of a sickle at that part where it ceases to be united with the crural arch. The concavity of this fold looks downward and inward, and is termed the falciform process; the latter, or pubic portion, coming from the pubes, passes over the pectineus and adductor muscles, and unites with the iliac portion, beneath the point where the saphena vein joins the femoral.

The external surface of the fascia lata is separated from the integuments by more or less fatty cellular tissue, in which a greater or less quantity of fat, blood-vessels, lymphatics, and nerves is deposited. Its in-

ferior surface covers the inferior part of the muscles of the abdomen, and all the superficial muscles of the thigh. *Structure*.—It is very thick on the outside, much less so anteriorly and posteriorly, and still less so on the inside, and is formed of fibres which intercross in different directions. On the outside it is formed of two very strong layers; which embrace the tensor vaginæ femoris muscle.

#### *Tibial Aponeurosis.*

This is continuous superiorly with the crural aponeurosis, with the fibrous expansions sent off from the tendons of the gracilis, semi-tendinosus, triceps, and sartorius muscles, and is inserted into the head of the fibula; more inferiorly it is attached to the anterior border of the tibia; at the inferior part of the leg it is continuous anteriorly with the annular ligament of the tarsus, and is fixed, on the outer side, to the sheath of the tendon of the peronei muscles, and on the inner side to the internal annular ligament. Its internal surface covers the superficial muscles of the leg, and gives attachment to the tibialis anticus, extensor communis digitorum pedis, and peroneus longus muscles. *Structure*.—It is very strong and dense anteriorly, thin in every other part.

#### *Anterior Annular Ligament of the Tarsus.*

*Situation*.—A little above the articulation of the ankle joint. *Form*.—Quadrilateral. *Attachment*.—On one side to the antero-external part of the superior depression of the calcaneum, on the other side to the anterior part of the internal malleolus. *Relations*.—Its posterior surface is in relation with the tendons of the extensor communis digitorum pedis, peroneus tertius, tibialis anticus, and extensor proprius pollicis pedis muscles. *Structure*.—It is formed by transverse and parallel fibres, divided into two folds, which embrace the tendons of the extensor longus digitorum communis and the peroneus tertius muscles.

*Internal Annular Ligament of the Tarsus.*

*Situation.*—At the inner part of the foot. *Attachment.*—Anteriorly to the anterior part of the internal malleolus; posteriorly to the postero-internal part of the calcaneum. It forms with the calcaneum a species of canal, which contains the sheaths of the tendons of the tibialis posticus, flexor longus digitorum pedis, flexor proprius pollicis pedis, and plantar vessels and nerves.

*Plantar Aponeurosis.*

*Form.*—Triangular, divided into three portions anteriorly, one middle, and two lateral. *Attachment.*—Posteriorly to the posterior and inferior eminences of the calcaneum; confounded anteriorly with the ligaments of the articulations of the phalanges of the toes with the metatarsus. *Relations.*—Inferiorly with the skin, superiorly with the muscles of the sole of the foot, some of which are attached to it.

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## ORDER II.

## VOCAL APPARATUS.

IT is composed of but one organ, the larynx.

## OF THE LARYNX AND ITS APPENDAGES.

[*Preparation.*—Remove the muscles from the hyoid regions, cutting across those attached to the maxillary bone and to the styloid process. Pull forward the tongue, larynx, and pharynx, and turn them over. In this mode the larynx becomes very apparent.]

*General Formation.*—The larynx is a regular, complicated organ, composed of pieces moveable on one another, open superiorly and inferiorly, placed at the anterior part of the neck, behind the muscles of the

inferior hyoid region and thyroid gland, in front of the pharynx and upper extremity of the œsophagus, beneath the base of the tongue, above the trachea, directed vertically: it is composed of cartilages, fibro-cartilages, ligaments, muscles, glands, membranes, vessels, and nerves.

## PARTS CONSTITUTING THE LARYNX.

### 1st. THE CARTILAGES OF THE LARYNX.

They are four in number, viz.:—The *thyroid*, *cricoid*, and two *arytenoid* cartilages.

#### *Thyroid Cartilage.*

*Situation.*—At the superior, anterior, and lateral parts of the larynx. *Form.*—Flattened from before backward, of greater extent transversely than from above downward, convex and prominent anteriorly, concave posteriorly, and divided into two surfaces and four borders. *Anterior face.*—Presenting in the middle a vertical prominence; laterally two plane surfaces, traversed posteriorly by a prominent line, which receives the insertion of the sterno-thyroid and thyro-hyoid muscles; and behind this line a small surface for the attachment of the inferior constrictor pharyngis muscle. *Posterior face.*—Presenting in the middle an angle for the attachment of the ligaments of the glottis and the thyro-arytenoid muscles; laterally two plane surfaces, receiving inferiorly the insertion of the crico-thyroid muscles, and corresponding in part to the lateral crico-arytenoid muscles. *Superior edge.*—Notched in the middle, giving attachment to the thyro-hyoidean membrane. *Inferior border.*—Presenting three notches, separated by two eminences, and giving attachment in the middle to the crico-thyroid membrane, and laterally to the crico-thyroid muscles. *Posterior edge.*—Lying upon the vertebral column, thick, rounded, receiving the insertion of some of the fibres of the stylo-pharyngi and palato-pharyngi; terminating superiorly by the great cornu of the thyroid cartilage, an eminence

which gives attachment by its summit to a ligament fixed to the great cornu of the os hyoides; terminating inferiorly in the small cornu, a process not so large as the former, and articulating by a surface on the inner side with the ericoid cartilage.

### *Cricoid Cartilage.*

*Situation.*—At the lower part of the larynx. *Form.* . —That of a ring, which is of greater vertical extent posteriorly than anteriorly; divided into two surfaces and two circumferences. *Exterior surface.*—Very narrow anteriorly, where the crico-thyroid muscles are attached; it is covered slightly on the sides by the thyroid gland, and presents a small eminence articulating with the lesser cornua of the latter; posteriorly broad, quadrilateral, and presenting a vertical prominence, and separated by two depressions for the insertions of the posterior crico-arytenoid muscles. *Interior surface.*—Covered by the mucous membrane of the larynx. *Superior circumference.*—Very oblique from above downward and from behind forward, giving attachment anteriorly to the crico-thyroid membrane; laterally to the crico-arytenoidei laterales; presenting posteriorly two surfaces articulating with the base of the arytenoid cartilages. *Inferior circumference.*—Horizontal, convex anteriorly, slightly grooved on the sides, uniting with the first ring of the trachea by means of a fibrous membrane.

### *Arytenoid Cartilages.*

*Situation.*—At the upper and posterior part of the larynx, above the cricoid cartilage. *Form.*—That of a triangular pyramid, divided into two faces, two edges, one base, and one summit. *Posterior edge.*—Concave, giving attachment to the arytenoid muscle. *Anterior face.*—In relation with a portion of the arytenoid gland, and receiving the insertion of the thyro-arytenoid muscles and ligaments of the glottis. *Internal edge.*—Covered by the mucous membrane of the larynx, and in contact with that of the opposite side.

*External edge.*—Prominent and convex. *Base.*—Articulating posteriorly with the cricoid cartilage, presenting on the outer side a tubercle for the attachment of the posterior and lateral arytenoid muscles; anteriorly a triangular eminence for the attachment of the ligament of the glottis. *Summit.*—Thin and sharp, covered by the mucous membrane of the larynx.

### 2d. FIBRO-CARTILAGES OF THE LARYNX.

The larynx has only one fibro-cartilage, the epiglottis.

#### *Epiglottis.*

*Situation.*—At the upper and anterior part of the larynx. *Form.*—Oval, slightly curved upward towards the tongue, terminating inferiorly in a point, divided into two surfaces and one circumference. *Lingual surface.*—Concave from above downward, convex transversely, covered superiorly by the mucous membrane of the mouth, united inferiorly to the os hyoides and to the base of the tongue. *Laryngeal surface.*—Convex from above downward, and concave transversely, covered superiorly by the mucous membrane of the larynx. *Circumference.*—Lined in its whole extent by the mucous membrane, fixed inferiorly by a contracted part to the notch of the superior border of the thyroid cartilage.

### 3d. ARTICULATIONS OF THE LARYNX.

#### *Thyro-hyoidean Articulations.*

These are formed, 1st, in the middle and laterally by means of a broad, dense, apparently fibrous membrane, termed the thyro-hyoid membrane, attached by its superior border to the posterior surface of the body and great cornua of the os hyoides, and by the inferior to the superior edge of the thyroid cartilage; 2d, Posteriorly by means of two fibrous cords, attached inferiorly to the summit of the great cornua of the thy-



roid cartilage, superiorly to the extremity of the body of the os hyoides.

*Crico-thyroid Articulation.*

These two cartilages are united together ; 1st, Anteriorly by the crico-thyroid membrane, attached to the two anterior thirds of the superior circumference of the cricoid cartilage, and to the middle part of the inferior border of the thyroid ; 2d, Laterally the lesser cornua of this latter cartilage are articulated with two surfaces of the cricoid, covered by a small synovial capsule, also by two ligaments, one anterior, the other posterior, mounting towards the base of the arytenoid cartilages, where they expand. The anterior surface of this articulation is covered by the sterno-hyoid and crico-thyroid muscles, and by a small artery which traverses it.

*Crico-arytenoid Articulation.*

The arytenoid cartilages and the cricoid cartilages are articulated by two surfaces, covered by a synovial capsule, and kept in place by fibrous ligaments.

*Thyro-arytenoid Articulations.*

The arytenoid cartilages are united by two broad ligaments, elongated, concurring to form the *cordæ vocales*, and formed of dense parallel fibres, attached posteriorly to the anterior prominence of the base of the arytenoid cartilages ; anteriorly to the middle of the angle of the thyroid cartilage, directed horizontally from behind forward and from without inward, and crossing, form the principal part of the *cordæ vocales*.

4th. MUSCLES OF THE LARYNX.

*Crico-thyroideus.*

*Situation.*—At the anterior and inferior part of the larynx. *Figure.*—Triangular. *Attachment.*—Inferi-

only to the anterior part of the external surface of the cricoid cartilage; superiorly to the lateral part of the inferior edge of the thyroid cartilage, and to the anterior edge of the lesser cornu. *Direction*.—Oblique from above downward and from without inward.

*Crico-arytenoideus Posterior.*

*Situation*.—At the posterior part of the larynx. *Figure*.—Triangular, thin, and flat. *Attachment*.—Inferiorly to the longitudinal depression observed on the right and left of the posterior prominent line of the cricoid cartilage; superiorly to the posterior part of the base of the arytenoid cartilage. *Direction*.—Oblique from below upward and from within outward.

*Crico-arytenoideus Lateralis.*

*Situation*.—At the lateral part of the larynx. *Figure*.—Thin, flat, and of the form of a trapezium. *Attachment*.—Inferiorly to the side of the superior circumference of the cricoid cartilage; superiorly to the external anterior part of the base of the arytenoid cartilage. *Direction*.—Oblique from below upward and from before backward.

*Thyro-arytenoideus.*

*Situation*.—Between the thyroid and arytenoid cartilages. *Figure*.—Irregular, thin, broad anteriorly, narrow posteriorly. *Attachment*.—Anteriorly to the inferior and middle part of the posterior surface of the thyroid cartilage; posteriorly to the external part of the base of the arytenoid cartilage. *Direction*.—Horizontal.

*Arytenoideus.*

This is a single muscle. *Situation*.—At the upper and posterior part of the larynx. *Figure*.—Quadrilateral, thin, and flat. *Attachment*.—To the posterior part of each of the arytenoid cartilages, from whence

the fibres take different directions: some mount from the base of the right cartilage to the summit of the left, others take an inverse course, and some pass horizontally from the middle part of one to the same point of the other.

#### 5th. GLANDS OF THE LARYNX.

Those of the epiglottis consist of a mass of small glandular grains, surrounded with cellular tissue; their excretory vessels open on the surface of the mucous membrane of the larynx; they are situated in front of the inferior part of the lingual surface of the epiglottis, behind the thyroid cartilage and thyrohyoid membrane.

Those termed the *arytenoid glands* are composed of small grains, similar to those of the lachrymal gland, and are situated in the folds of the mucous membrane, in a line from the epiglottis to the arytenoid cartilages, and from these latter to the thyroid cartilage.

#### 6th. MUCOUS MEMBRANE OF THE LARYNX.

This is continuous superiorly with the mucous membrane of the mouth; inferiorly with that of the trachea and bronchial tubes; posteriorly with that of the pharynx. It goes from the base of the tongue on the anterior face of the epiglottis, and forms three folds, a central and two lateral: the membrane covers the posterior face of the larynx, and forms laterally two other larger folds, which terminate posteriorly in the arytenoid cartilages, and cover a part of the thyro-arytenoid muscles; it then penetrates into the larynx, and towards the base of the arytenoid cartilages forms two new lateral folds, which are directed anteriorly towards the re-entering angle of the thyroid cartilage; still lower it covers the ventricles of the larynx, and inferiorly it embraces the thyro-arytenoid ligament, and covers the cricoid cartilage and the crico-thyroid membrane. *Organization.*—It

has a rosy colour, is soft, spongy, very resisting, and contains in its tissue many mucous follicles.

The arteries and veins of the larynx arise from the superior and inferior thyroid vessels. Its lymphatics terminate in the inferior jugular ganglia. Its nerves proceed from the par vagum, and from the two superior cervical ganglia.

#### OF THE LARYNX IN GENERAL.

It is divided into two surfaces and two extremities. 1st, *Exterior surface*.—Presents anteriorly the vertical prominence of the thyroid cartilage; the two lateral surfaces marked by the horizontal line; laterally a triangular surface, covered by the inferior constrictor and lesser cornua of the thyroid cartilage articulating with the cricoid; posteriorly a convex surface, formed by the arytenoid and cricoid cartilages; two lateral grooves, broader and deeper superiorly than inferiorly; and lastly, the posterior border of the thyroid cartilage applied on the vertebral column. 2d, *Interior surface*.—Presents from above downward, 1st, the superior ligaments of the glottis, lateral horizontal folds of the mucous membrane, directed forward and inward; 2d, the inferior ligaments of the glottis, or *cordæ vocales*, of the same figure as the preceding, parallel and formed by the thyro-arytenoid ligaments, covered by the mucous membrane; 3d, between these ligaments, the ventricles of the larynx, cavities elongated from before backward, the opening of which is turned inward and upward; 4th, lastly, the glottis, an opening oblong from behind forward, about ten lines in length, broader posteriorly than anteriorly, comprised between the superior and inferior ligament of one side and those of the opposite one. *Upper extremity*.—It is much more sloping than the lower, and presents, from before backward, the upper edge of the thyroid cartilage, the triangular space occupied by the glands of the epiglottis, the epiglottis and its mucous folds, and the upper orifice of the larynx, situated above the glottis, having the figure of a tri-

angle, the base of which is anterior, the summit posterior, formed anteriorly by the epiglottis, posteriorly by the arytenoid cartilages, and on the sides by the epiglotti-arytenoid mucous folds. *Lower extremity.*—It is circular, formed by the lower circumference of the cricoid cartilage, and united by a fibrous membrane to the first ring of the trachea.

#### THYROID GLAND.

*Situation.*—In front of the antero-inferior part of the larynx, and in front of the first rings of the trachea. *Form.*—Composed of two oval lobules, flattened from before backward, elongated vertically, sometimes united in the greater part of their extent, sometimes separated, most frequently found united by a transverse portion. *Anterior surface.*—Covered by the sterno-thyroid, sterno-hyoid, platysma myoides, omo-hyoideus, and sterno-mastoid muscles. *Posterior surface.*—United to the larynx and to the first rings of the trachea by cellular tissue, and applied on the thyro-hyoid and crico-thyroid muscles. *Lateral borders.*—Applied on the primitive carotids, internal jugular veins, pneumogastric nerves, their recurrent branch, and the great sympathetic nerve; the lateral border of the left side lies over the œsophagus. *Superior border.*—Notched in the middle. *Inferior border.*—Convex. *Superior extremities.*—Placed between the primitive carotids and the thyroid cartilage. *Inferior extremities.*—Lodged between these arteries and the trachea. *Organization.*—Its tissue is soft, spongy, of a reddish-brown colour, formed of lobes, lobules, and granulations, which contain a fatty humour; it receives four arteries, which come from the subclavian and carotids; the veins which accompany these arteries, and which form a frequent anastomosis at its inferior part. Its nerves are furnished by the par vagum, and by the ganglionic system; its lymphatics proceed towards the ganglia of the neck.

## ORDER III.

## EXTERNAL SENSITIVE APPARATUS.

THE external sensitive apparatus embraces the eye, the ear, the nose, the nasal fossæ, the tongue, and skin.

## ARTICLE I.

## OF THE EYE AND ITS APPENDAGES.

[*Preparation.*—The study of this organ is generally commenced on the eye of an ox, where the constituent parts are larger and more apparent.]

Under this term are comprehended the eyebrows, eyelids, and globe of the eye.

## EYEBROWS.

These are two arched eminences, lying on the superciliary ridges of the frontal bone: they are covered with hair, the direction of which is from within outward. They are formed of a dense fold of skin, in subjacent cellular and fatty layers, and by the corrugator supercilii muscles.

## EYELIDS.

*Situation.*—At the anterior part of the eye, distinguished into the superior and inferior. *Figure.*—They represent two moveable membranous veils, corrugated transversely, united at their extremities to form two angles, the internal of which is the larger, and the external the smaller, contiguous by their loose edges, which are cut obliquely from before backward, the superior from below upward, the inferior from above downward, so as to form, when they approximate, a narrow and triangular canal on the globe of the eye. The loose edges of the eyelids present, near the inner angle, the orifices of the puncta lachrymalia, and in almost all their extent a range of small foramina, the excretory orifices of the Meibomi-

an glands, open on the side of the eye, before which we see the lashes, firm and solid hairs, arranged in two rows. Those of the upper lid are directed first downward, and then curved upward; those of the lower have an opposite direction. *Organization.*—They consist, 1st, Of a layer of thin, loose, transparent skin; 2d, Of a portion of the orbicularis palpebrarum; 3d, Of a fibrous membrane, placed in the external part of each lid, fixed by one part to the corresponding portion of the base of the orbit, by the other to the tarsal cartilage; 4th, Of the tarsal cartilages, thin elastic plates, flattened from before backward, elongated transversely, placed on the same plane with the fibrous membrane, commencing at the bifurcated extremity of the tendon of the orbicularis palpebrarum, terminating on the outer side towards the external canthus, covered anteriorly by the orbicularis muscle, posteriorly by the conjunctiva, adhering by one of their borders to the fibrous membrane, by the other corresponding to the eyelashes; 5th, Of the Meibomian glands, small, round, hard, white, or yellowish follicles, placed in the grooves between the tarsal cartilages and the conjunctiva, ranged the one above the other so as to form yellowish vertical lines, their excretory ducts opening near the free border of the eyelids; 6th, Of the conjunctiva, a mucous membrane which covers the posterior surface of the eyelids, and anterior part of the globe of the eye as far as the circumference of the cornea; at the internal angle of the eye it forms a fold, which seems to be the rudiment of the membrana nictitans so well developed in certain animals.

The arteries supplying the eyelids come from the ophthalmic, infra-orbital, temporal, and facial branches; the nerves proceed from the lachrymal, facial, infra-orbital, frontal, and nasal branches of the fifth pair.

#### OF THE GLOBE OF THE EYE IN GENERAL.

*Situation.*—In the inner and anterior part of the orbit. *Figure.*—That of a spheroid, united anteriorly

to the segment of the smaller sphere, which forms about the anterior fifth of the eye. *Dimensions*.—The antero-posterior diameter is from ten to eleven lines in extent, and greater than the transverse; the eye is larger in young subjects than in old. *Direction*.—Different from that of the orbit, the axis of the eyes being parallel to one another. *Relations*.—Anteriorly with the conjunctiva; posteriorly and in its whole contour with the recti and obliqui muscles, the vessels and nerves, and a considerable quantity of fat; in the superior external part with the lachrymal gland; in the inner and inferior part with the caruncula lachrymalis. *Organization*.—The eye is composed of membranes and humours.

#### MEMBRANES OF THE EYE.

These are, properly speaking, the *sclerotica*, *cornea*, *choroides*, *iris*, *hyaloidea*, and *retina*, to which may be added the ciliary circle and processes.

1st, *Sclerotica*. *Situation*.—This occupies the four posterior fifths of the eye, and is the most external membrane. *Form*.—That of a sphere, truncated anteriorly. *External face*.—It has the same relations as the globe of the eye; near the cornea, it is fortified by the expansion of the aponeuroses of the recti and oblique muscles, which seem identified with it, and which has been termed the *membrana albuginea*. *Internal face*.—Covered by the choroides. *Posterior opening*.—Narrow, round, and traversed by the optic nerve; sometimes, in place of a simple opening, a number of small openings are observed, and one or two larger than the rest, for the passage of the central artery and vein of the retina. *Anterior opening*.—Broad, nearly circular, the transverse diameter being a little greater than that from above downward, about six lines in diameter, its circumference feather-edged at its internal border to receive the cornea. *Organization*.—This is a hard and opaque fibrous membrane, composed of fibrous filaments, decussating and continuous with the external sheath of the optic nerve.



2d, *Cornea*.—It occupies the anterior fifth of the eye, and is incased in the anterior opening of the sclerotica. *Figure*.—Nearly circular, the transverse diameter being a little greater than the vertical, convex anteriorly, concave posteriorly, from about seven to seven lines and a half in diameter. *Anterior face*.—Convex, and covered by a peculiar species of epidermis, distinct from the conjunctiva. *Posterior face*.—Covered by the membrane of the aqueous humour, and bounding the anterior chamber, a space comprised between the iris and cornea. *Organization*.—The cornea is a transparent membrane, composed of six plates placed on one another, between which we observe a small quantity of serosity.

3d, *Choroides*. *Situation*.—Between the sclerotica and retina, extending from the opening of the optic nerve as far as the ciliary circle. *External face*.—Covered by a brownish crust, united to the internal surface of the sclerotica. *Internal face*.—Covered with a similar crust, but more abundant and of a deeper colour; posteriorly, near the optic nerve, this *pigmentum nigrum* is replaced by a whitish circle; it is contiguous to the retina. *Posterior opening*.—Narrow, rounded, traversed by the optic nerve; its contour presents a prominent border, not attached to the optic nerve, and therefore should not be considered as continuous with the pia mater, as some have supposed. *Anterior opening*.—Broad, intimately adherent to the ciliary circle and processes. *Organization*.—It appears entirely composed of a vast number of arterial and venous ramifications, united by very fine cellular tissue; the arteries distribute themselves principally to its exterior surface, the veins to the interior; posteriorly these vessels form two planes, the internal of which is termed the *membrana Ruyschiana*.

4th, *Ligamentum ciliare*. *Situation*.—Between the choroid, iris, and sclerotica. *Figure*.—That of a grayish ring, one or two lines broad, pulpy, intimately united by its great circumference with the choroid, and by its lesser one with the iris, which is incased, as it were, in it; covered on the inner side by the ciliary processes.

5th, *Processus ciliares*. *Situation*.—Between the iris and vitreous humour. *Figure*.—In the form of a ring, composed of vasculo-membranous folds, varying from 60 to 80, elongated, narrowed at their extremities, broader in the middle, each extending from the choroid membrane as far as the contour of the pupil, arranged in a radiated manner, and forming by their union a circular ring, placed behind the iris and corpus ciliare, in front of the anterior part of the vitreous humour, which receives each fold or process in a peculiar depression; surrounding the crystalline lens like a crown.

6th, *Iris*. *Situation*.—At the anterior part of the globe of the eye, in the middle of the aqueous humour. *Figure*.—Circular, flattened from before backward, pierced in its middle by an opening termed the pupil, separating the anterior chamber of the eye from the posterior. *Direction*.—Vertical. *Anterior face*.—Covered by the membrane of the aqueous humour, variously coloured, presenting two concentric tinges, the one internal, deeper marked, the other external; also presenting some radiated striæ, which, commencing at the great circumference of the iris, terminate at the pupil where they bifurcate; their number varies from 70 to 80. *Posterior face*.—Covered by a thick black crust, termed the *uvea*, which is continuous with that from the internal surface of the choroid membrane in the intervals of the ciliary processes; this surface is in immediate contact with these processes. *Great circumference*.—Corresponds from without inward to the ciliary ligament, choroid membrane, and ciliary processes. *Organization*.—Not accurately determined, but considered to be muscular. In the fœtus, until the seventh month, the pupil is obstructed by a membrane termed the *membrana pupillaris*; it is formed of two diaphanous folds, the posterior belonging to the posterior chamber of the eye, the anterior to the membrane of the aqueous humour, which covers the posterior surface of the cornea and the anterior chamber of the eye; it is smooth, and fixed to the circumference of the pupil

so as to make the anterior surface of this latter one continuous plane.

7th, *Retina*.—The third membrane of the eye, extending from the optic nerve as far as the crystalline lens; embraces the vitreous humour, without forming any connexion with it; it commences behind, around the bulbous extremity of the optic nerve. *External face*.—Contiguous with the choroid and ciliary processes, which are covered by a thin plate of this membrane, and which dips into their intervals and arrives at the crystalline lens. *Internal face*.—Resting on the vitreous body; about two lines on the outer side of the optic nerve, the *yellow spot of Sæmmering* is observed, and which is exactly in the axis of the eye; in its centre a small hole is observed; it is on the internal surface of the retina that its artery ramifies. *Organization*.—A very soft, pulpy, transparent, and very thin membrane, of the same nature as the medullary substance of the nerves, arising posteriorly around the tubercle formed by the optic nerve, not being formed by the expansion of this, presenting, two lines from this nerve on the outside, a yellow spot and a very narrow hole in the midst of a kind of fold.

#### HUMOURS OF THE EYE.

1st, *Aqueous humour and its membrane*.—This is a limpid and transparent fluid, varying in quantity from four to six grains; it occupies the anterior and posterior chambers of the eye, from the cornea as far as the crystalline lens, and is contained in a thin, transparent membrane, which covers the wall of the anterior chamber.

2d, *Crystalline lens and its membrane*. *Situation*.—Between the aqueous and vitreous humours, at the union of the two posterior thirds of the eye with its anterior third. *Figure*.—Lenticular, about four lines in diameter and two in thickness; corresponding by its axis to the centre of the pupil. *Anterior face*.—Separated from the iris and ciliary processes by the

posterior chamber. *Posterior face*.—Lodged in a cavity in the anterior face of the vitreous humour; this surface is more convex than the anterior one. *Circumference*.—United to the vitreous humour more intimately than its posterior surface. *Organization*.—Perfectly transparent in the adult, slightly red in the fœtus, and yellowish in old age; composed of two layers, one exterior, soft, pulpy, easy to be removed; the other central, formed by concentric plates, each plate consisting of concentric fibres. *Capsule of the crystalline lens*.—Transparent, thick, forming a sac without an opening, enveloping the lens, embraced by the *membrana hyaloidea*; presenting between it and the crystalline lens the liquor Morgagni, a transparent fluid.

3d, *Vitreous humour and membrana hyaloidea*. *Situation*.—It occupies the three posterior fourths of the globe of the eye. *Figure*.—Spherical, depressed and concave anteriorly; embraced, posteriorly and laterally, by the retina, which does not adhere to it; covered anteriorly by the crystalline lens and ciliary processes. *Organization*.—Soft, perfectly transparent, gelatinous, very soluble in water, united to the rest of the eye only by the middle branch of the central artery of the retina, which traverses it to ramify in the posterior part of the crystalline lens. *Membrana hyaloidea*.—Exceedingly thin and transparent, forming a multitude of cells containing the vitreous humour, and communicating with one another; divided anteriorly into two plates, one of which passes in front of the capsule of the crystalline lens, the other behind it, leaving at the place of their separation a triangular space, which is termed the canal of Petit.

## ARTICLE II.

### THE EAR AND ITS APPENDAGES.

[*Preparation*.—We generally select for this purpose the head of an adult or child. The external auditory foramen is laid bare as far as the tympanum, removing the pavilion of the ear, the lower

maxillary bone, the parotid gland, and the surrounding parts. We remove with a chisel a portion of bone, including the mastoid process and the glenoid fissure. We then see the auditory passage and the cavity of the tympanum. To see the Eustachian tubes, we cut the trachea and the œsophagus to the vertebral column, turn forward the pharynx, and open it to the base of the scull. The insertions of the external and internal muscles of the malleus may be seen by making in the head a perpendicular section, which would pass through the crista galli process and the occipital foramen, removing the inferior maxillary bone, the temporalis, the masseter, the pterygoidei, preserving the auditory passage, the peristaphylini muscles, and the internal carotid artery. The preparation of the tensor tympani muscle consists in exposing the membrane of the tympanum, which is raised to show the stapedis muscle and the little bones of the ear. The labyrinth is prepared in the disarticulated temporal bones which are taken from young subjects. We first remove with a scalpel the anterior surface and upper edge of the petrous portion of the temporal bone, which exposes the anterior vertical semicircular canal. Another section, which removes the osseous septum, which extends from the environs of the external orifice of the aqueduct of the vestibule to the mastoid process, shows the posterior vertical canal. The horizontal canal is prepared by chiselling between the vertical canals and the squamous portion of the temporal bone. The vestibule is discovered by removing the portion of bone placed in front of the anterior vertical canal. Finally, we see the cochlea, by removing very carefully the spongy tissue which fills the space between the internal auditory passage and the carotid canal. We thus come to the tubes of the cochlea, which may be opened to their extremities.]

The ear is divided into three parts: 1st, The external ear, which embraces the cartilage and the auditory passage; 2d, The middle ear, formed by the cavity of the tympanum and its appendages; 3d, The internal ear, formed by a series of cavities known as the *labyrinth*.

#### OF THE EXTERNAL EAR.

The pavilion of the ear presents, 1st, The *helix*, a semicircular prominent eminence, which commences in the centre of the concha, above the auditory passage, terminating posteriorly and inferiorly by a bifurcation, which is continuous with the *anti-helix* and *lobule*; 2d, The groove of the helix, a deep fissure

which follows the course of the helix, below which it is placed; 3d, The *anti-helix*, a curved prominence, extending from near the bifurcation of the helix as far as the *anti-tragus*; 4th, The navicular fossa, a superficial depression, which separates the two roots of the anti-helix; 5th, The *tragus*, a little, flat, prominent, and triangular eminence, placed on the outer and anterior part of the auditory canal; 6th, The *anti-tragus*, a mamellated eminence, smaller than the preceding, situated opposite to it, beneath the anti-helix; 7th, The *concha*, a deep cavity, bounded superiorly and posteriorly by the anti-helix; 8th, The *lobule*, a soft, round eminence, terminating the inferior circumference of the pavilion; 9th, The *pavilion*, which forms the greater part of the fibro-cartilage of the ear. The inner face presents prominences and depressions the opposite of those on the external face. *Organization.*—The pavilion is formed by a layer of skin, a fibro-cartilage, ligaments, and muscles. 1. *Cutaneous layer.*—It adheres firmly to the fibro-cartilage, and forms the lobule; it contains many sebaceous follicles. 2. *Fibro-cartilage.*—It constitutes essentially the pavilion of the ear, which presents the eminences and depressions described above. 3. *Ligaments.*—Of these there are three of cellular structure; one *superior*, attached behind the concha and to the epicranial aponeurosis; one *anterior*, extending from the base of the tragus and the adjacent region of the helix to the zygomatic process, above the temporo-maxillary articulation; a third *posterior*, attached to the convexity of the concha and to the base of the mastoid process. 4. *Muscles.*—These are but slightly marked, are not constant, and are five in number. 1. The *muscle of the tragus.*—This is triangular, and is situated on the external face of the tragus, extending from the base to its summit. 2. The *muscle of the anti-tragus.*—Narrower and thicker than the preceding, situated in the space between the anti-tragus and the anti-helix. 3. The *great muscle of the helix.*—Very thin, covering in the space of a few lines the origin of the helix, above the tragus. 4. The *small muscle of the helix*, which is very

thin, and often absent; it is placed in the transverse prominence of the helix, which separates the concha into two parts. 5. Finally, the *transverse muscle*, situated behind the pavilion, and extending from the convexity of the concha to the posterior prominence of the groove of the helix.

#### AUDITORY CANAL.

*Situation*.—Between the articulation of the temporal with the maxillary bone and mastoid process. *Figure*.—Broader at its extremities than in its middle part; about ten or eleven lines in length, separated from the tympanum by the *membrana tympani*. *Direction*.—Oblique from without inward, curved in its course. *Organization*.—It is formed, 1st, By an osseous portion belonging to the temporal bone; 2d, By a prolongation of the fibro-cartilage of the concha, which is triangular, broad, curved, and forms only a portion of the duct; 3d, By a fibrous portion, which unites superiorly and posteriorly the two edges of fibro-cartilage, and completes the passage in this part; 4th, By a layer of skin, a prolongation of the skin of the pavilion, reflected on the membrane of the tympanum, forming a cul-de-sac, which is provided with long hairs, presenting the excretory orifices of the ceruminous glands; the latter are spherical yellow organs, situated in the cellular tissue, under the skin, above and behind the auricular passage.

### II. MIDDLE EAR, OR TYMPANUM.

It comprises a bony cavity, the bones of the ear, the muscles, and a mucous membrane.

#### OF THE CAVITY OF THE TYMPANUM.

*Situation*.—In the base of the petrous portion of the temporal bone, above the glenoid cavity, in front of the mastoid process, and behind the Eustachian tube. *Form*.—Irregular, presenting six parietes. *External wall*.—Nearly entirely formed by the *membrana tym-*



pani, which is a thin, transparent, fibrous septum, covered on the outer and inner side by prolongations of the skin and mucous membrane, directed a little obliquely from above downward, from without inward, and from behind forward; circular, concave on the outer side, convex within, and united to the extremity of the malleus. *Internal wall.*—It presents, 1st, The *fenestra ovalis*, an opening whose great diameter is horizontal, and small one vertical, communicating with the vestibulum, nearly completely filled by the base of the *stapes*, bounded superiorly by an elongated prominence hollowed by the *aqueduct of Fallopius*; 2d, The *promontorium*, a tubercular eminence, formed by the external side of the *vestibulum* and corresponding portion of the *cochlea*, bounding inferiorly the *fenestra ovalis*; 3d, The *fenestra rotunda*, situated at the base of an irregular canal, behind and beneath the *promontorium*, of a triangular shape, forming the communication between the internal part of the *cochlea* and the cavity of the *tympanum*, and closed in by a membrane. *Superior wall.*—Presenting a few openings traversed by bloodvessels. *Inferior wall.*—We observe here the *glenoidal fissure*, from which pass the long process of the malleus, the *corda tympani*, and *laxator tympani*. *Posterior wall.*—It presents superiorly a short canal, directed obliquely backward and downward, with a triangular orifice opening into the *mastoid cells*; these are cavities of different sizes, communicating together, and hollowed in the *mastoid process*. Above the opening of the *mastoid cells* we observe the *pyramid*, or *eminentia pyramidalis*, a small, conical, hollow eminence, containing the muscle of the *stapes*, the tendon of which comes out by its summit. Beneath the base of the *pyramid* is a small opening which communicates with the *aqueduct of Fallopius*, and which is traversed by the superior branch of the *vidian nerve*. *Anterior wall.*—This presents a small, thin, curved plate, termed the *processus cochleariformis*, separating two canals, one superior, narrow, and occupied by the *tensor tympani*.



ni; the other inferior, broad, and forming the osseous portion of the Eustachian tube.

*Eustachian tube.*—This extends from the cavity of the tympanum as far as the superior part of the pharynx, about two inches in length, directed obliquely forward, inward, and downward, not so broad posteriorly as anteriorly, terminating by an expanded orifice behind the posterior opening of the corresponding nasal fossa; formed, 1st, By an osseous portion, situated above the carotid canal, on the inner side of the glenoid fissure, in the re-entering angle of the temporal bone; 2d, By a fibro-cartilaginous portion, placed on the inner side, triangular, curved on itself, forming the internal parietes and the superior part of the external one; 3d, By a membranous portion, forming nearly the external half of the passage, uniting the two borders of the fibro-cartilage, composed of a prolongation of the mucous membrane of the pharynx, which lines the whole cavity.

#### OF THE BONES OF THE EAR.

These are the *malleus*, *incus*, *stapes*, and *os orbiculare*.

*Malleus.* *Situation.*—On the inner and upper part of the membrane of the tympanum. *Figure.*—Elongated, divided into the head, neck, and handle. 1st, The head is smooth, ovoid, corresponding on the outer side to the osseous portion of the temporal bone, articulating posteriorly with the *incus*. 2d, The neck is narrow and in relation with the upper part of the membrane, giving origin anteriorly to the process of *Raw*, which is a delicate, elongated eminence, traversing the glenoid fissure, and giving insertion by its summit to the *laxator tympani*. 3d, The handle is narrower than the neck, and forms with it an angle which presents a small prominence for the attachment of the *tensor tympani*, adhering on the outer side to the *membrana tympani*.

*Incus.* *Situation.*—On the side of the malleus and a little behind it. *Figure.*—Irregular, divided into a body and two branches. 1st, The body, directed for-

ward and upward, presents two uneven tubercles, separated by a depression; articulating with the head of the malleus. 2d, The superior branch is short, conoid, pointed, and lies on the mastoid cells. 3d, The inferior branch is longer, is directed perpendicularly downward, and articulates by its summit with the os orbiculare.

*Os orbiculare*.—This bone is much smaller than the three others, is rounded, and articulates with the long branch of the *incus* and head of the *stapes*.

*Stapes*. *Situation*.—Between the os orbiculare and fenestra ovalis, in a horizontal direction. *Figure*.—That of a stirrup, divided into a head, two branches, and a base. 1st, The head is very small, a little concave, and articulates with the os orbiculare; it is supported by a very narrow neck, which gives attachment to a small muscle. 2d, The branches are separated from one another, leaving between them a space of the form of a parabola, and occupied by a membrane. 3d, The base, situated on the inner side, is elongated from before backward, is applied on the fenestra ovalis, which it completely closes in.

#### OF THE MUSCLES OF THE TYMPANUM.

*Tensor tympani*. *Situation*.—On the anterior border of the petrous portion of the temporal bone, in the osseous canal, situated above the Eustachian tube. *Figure*.—Elongated and very narrow. *Attachment*.—Anteriorly in part to the cartilaginous portion of the Eustachian tube, and partly to the rough surface presented by the petrous portion of the temporal bone; anteriorly to the inferior opening of the carotid canal; posteriorly to the angle formed by the junction of the handle with the neck of the malleus. *Direction*.—Obliquely backward and outward.

*Laxator tympani*. *Figure*.—Thinner than the preceding. *Attachment*.—Anteriorly to the spinous process of the sphenoid bone, and to the external portion of the Eustachian tube; posteriorly to the summit of the process of Raw, lodged in the glenoid fis-

sure. *Direction*.—Oblique from before backward and from within outward.

*Stapedius. Situation*.—In the cavity of the pyramidal eminence. *Figure*.—More delicate, and smaller than the two other muscles. *Attachments*.—Within the pyramid, by its fleshy portion which is contained there, and by its tendon, which proceeds from the summit of this eminence to the posterior part of the neck of the stapes.

#### MUCOUS MEMBRANE OF THE TYMPANUM.

This membrane, apparently fibrous externally, is a prolongation of the mucous membrane of the pharynx, which penetrates through the Eustachian tube into the tympanum, and covers its parietes. It contributes to close the fenestræ ovalis et rotunda, is fitted to the membrane of the tympanum, from which it is separated by the handle of the malleus, embraces the pyramid, the tendon of the muscle of the stapes, the cord of the tympanum, the little bones of the ear, and lines the mastoid cells.

#### III. OF THE INTERNAL EAR, OR LABYRINTH.

The labyrinth is situated between the tympanum and internal auditory canal, and is composed of the following parts.

1. *Vestibulum. Situation*.—Behind the cochlea, in front of the semicircular canals. *Form*.—An irregular spheroidal cavity, divided into two portions by a crest, presenting, 1st, On the outer side, the fenestra ovalis, closed up by the base of the stapes and proper membrane of the vestibulum; 2d, Superiorly, the two anterior orifices of the semicircular canals, the vertical, superior, and horizontal; 3d, Posteriorly, the two separate openings of the semicircular canals, and one opening common to the two vertical canals; 4th, On the inner side, very many small openings, traversed by vascular ramifications and branches of the auditory nerve; 5th, Near the common orifice of the vertical canals, the orifice of the aqueduct of the vesti-

bulum, extremely small and narrow, extending from this cavity to the posterior surface of the petrous portion of the temporal bone, where it opens.

2. *Cochlea. Situation.*—In the anterior part of the petrous portion of the temporal bone, on the inner side of the vestibulum. *Figure.*—An osseous cavity, formed by two conical canals, twisted in a spiral form, presenting, 1st, The *modiolus*, or *axis*, a bony portion, conical, commencing at the internal auditory canal, directed forward and outward towards the internal part of the horizontal portion of the carotid canal, terminating at its summit by a small cavity termed the infundibulum. 2d, The *lamina spiralis*.—Forming around the modiolus, to which it is united, two spiral turns; these gradually decrease in size, as also the cavity in which they are formed, in advancing towards the infundibulum. 3d, The *spiral septum*.—Divides the cavity of the cochlea into two smaller ones; it consists of an osseous portion, which is continuous by its concave border with the modiolus, and of a membranous portion fixed to the middle of the lamina spiralis, and existing only from the middle of the second turn as far as its summit, where it is pierced by a small hole. 4th, The *giri*, which are spiral cavities formed by the septum; they contract gradually, communicating together by the opening at the summit of the septum, and are divided into the internal, which commences at the fenestra rotunda, and the external, which opens into the vestibulum. 5th, *Aqueduct*.—An extremely narrow passage, opening superiorly into the cavity of the tympanum, near the foramen rotundum; inferiorly on the posterior border of the petrous portion of the temporal bone by a broad orifice.

3. *Semicircular canals. Situation.*—In the thickness of the petrous portion of the temporal bone; in relation, posteriorly and inferiorly, with the mastoid cells; anteriorly with the vestibulum. *Figure.*—Semicircular, opening into the vestibulum by five orifices. These canals are three in number, and their direction is different; two are vertical, a superior and

a posterior, while the third is horizontal. 1. *Superior vertical canal*.—Not so extensive as the posterior, the convexity of its curve directed upward. 2. *Posterior vertical*.—It is convex posteriorly, and its extremities are placed, the one anteriorly, the other posteriorly. 3. *Horizontal canal*.—The smallest of the three, situated between the two preceding, presenting its convexity posteriorly.

4. *Soft parts of the inner ear*.—The cavities of the internal ear are lined by a delicate, fine membrane; the semicircular canals contain each a membranous tube, opening into a common sac, which occupies a portion of the vestibulum, and contains, besides these tubes, a small quantity of a peculiar fluid. The vestibule is lined by another sac, very adherent to its walls; it is filled with a fluid, and sends a prolongation of its membrane into the aqueduct of the vestibulum.

### ARTICLE III.

#### OF THE NOSE AND NASAL FOSSÆ.

[*Preparation*.—To show the nasal fossæ we remove the arch of the cranium, and make in the head a vertical section, which passes through the centre of the occipital foramen and on the sides of the crista galli process.]

#### NOSE.

*Situation*.—In the centre of the face. *Organization*.—The nose is formed, 1st, By the bones and muscles already described; 2d, By a layer of skin, containing a number of small yellow follicles; 3d, By the cartilages, distinguished into the lateral and middle one, or septum. This latter is triangular, vertical, covered laterally by the pituitary membrane, articulated by its superior border with the inferior border of the perpendicular plate of the ethmoid bone; the posterior part of its inferior border is received into the groove of the vomer; the anterior is placed between the internal branches of the fibro-cartilages of the nasal orifices; its anterior border is thick, promi-

ment, and sub-cutaneous. The lateral cartilages placed on the sides of the nose are triangular, and united anteriorly to the superior part of the anterior border of the cartilage of the septum; they are fixed superiorly to the inferior border of the nasal bones, and to the ascending process of the superior maxillary bone; inferiorly to the fibro-cartilages of the nasal orifices; 4th, By the fibro-cartilages, two anterior and two posterior; the first, which are curved on themselves, represent a species of ellipsis, truncated posteriorly, and formed each of two branches, one external, situated in the inferior part of the *alæ nasi*, terminating in a point posteriorly, and united to the lateral cartilage; the other internal, concurring to form the inferior part of the septum, and contiguous with that of the opposite side, terminates in a point posteriorly. The second, termed the fibro-cartilages of the *alæ nasi*, are irregular, situated at the posterior part of the *alæ*, fixed by a fibrous and membranous tissue to the preceding cartilages, to the lateral cartilages, and to the concave border of the superior maxillary bone.

The nasal fossæ, covered by the pituitary membrane, present on their external parietes three grooves, which correspond to the superior, middle, and inferior meatus, which are separated by the turbinated bones. The mucous membrane lines the whole nasal fossæ, passes into the ethmoidal cells, frontal sinuses, maxillary sinus, posterior ethmoidal cells, sphenoidal sinuses, and communicates with that of the lachrymal passages by means of the inferior orifice of the nasal duct. *Organization of the pituitary membrane.*—It is thicker and softer than the other mucous membranes, and its red colour is much more marked except in the sinuses; it is whitish, solid, and dense next the bones, spongy next the cavities, formed by two layers, which are intimately united; an external mucous membrane, and another which is fibrous, adhering to the bones, to which it serves for periosteum. It contains mucous glands less apparent than in the other membranes of the

same class. It presents, in a fold which surrounds the orifice of the maxillary sinus, one of these glands, which is large, and of an irregular form ; and near the nostrils we perceive a few hairs. The pituitary membrane of the sinus is very thin, whitish, and formed of one layer.

## ARTICLE IV.

### OF THE TONGUE.

The superior or dorsum of the tongue presents in the middle a superficial groove, terminated posteriorly by a depression, into which the excretory ducts open, and on the sides of which proceed two lines formed of mucous follicles, directed forward and outward, and representing the letter V. Its inferior surface presents in its middle part a longitudinal groove, which separates two oblong prominences formed by the lingual muscles ; in its anterior third it is free ; by its middle and posterior part it is fixed to the inferior maxilla and os hyoides. The base of this organ is thick, and is continuous with the epiglottis and pillars of the velum palati, and becomes very thin at the point of its attachment to the os hyoides.

*Organization.*—It is formed, 1st, By the stylo-glossus, genio-glossus, hyo-glossus, and lingualis muscles ; 2d, Of the mucous membrane, which is a continuation of that of the mouth. This covers the lower face of the tongue, and forms at the maxillary symphysis a fold termed the *frenum* ; it then covers its sides. On the back of the tongue, this membrane, covered by a thin epidermis, presents three different orders of eminences, termed papillæ, disposed in two lines, uniting in the form of the letter V ; some of these papillæ are rounded and supported by a pedicle ; these are scattered on the borders and point of the tongue ; others are conical, and occupy the greater part of the superior surface of this organ, and appear formed by the expansion of the filaments of the lingual nerve. The tongue receives many nerves from



the inferior maxillary, the glosso-pharyngeal, and the hypo-glossal nerves; arteries which come from the external carotid, veins, and lymphatics.

## ARTICLE V.

### OF THE SKIN.

*General arrangement.*—The skin is a thick, dense, extensible membrane, forming the general covering of the body, and continuous at the different orifices, as the mouth, eyes, nose, &c., with the mucous membranes. Its external surface is covered by small eminences, and wrinkles more or less numerous, some depending on the action of the muscles, others produced by the arrangement of the papillæ; it also presents numerous pores on this same surface, the one the excretory orifices of the sebaceous follicles, the others the orifices of the exhalants and absorbents. It is covered with hair in certain regions, and varies in colour in the different races. *Inner surface.*—United to the subjacent parts by a cellular tissue, the arrangement of which varies much.

*Organization.*—It is composed of three layers: 1st, The *Dermis*.—Its thickness is more considerable than that of the other parts of the skin, and varies in the different regions of the body. It is white, very resisting, formed of fibrous lamellæ; pierced by a vast number of areolæ, the openings of which, more extensive on the internal surface, are traversed by the hairs, nerves, exhalants, absorbents, and bloodvessels. Its internal surface is united loosely to the sub-cutaneous cellular tissue, except at the sole of the foot and palm of the hands, and on the median line of the body. The external surface is covered by the rete mucosum, and presents numerous papillæ.

2. *The rete mucosum.*—This is composed, according to Gaultier, of four distinct layers; the first, counting from within outward, is formed of bloodvessels, arranged like granulations on the asperities of the derma; the second are whitish, applied upon the former,



and in the intervals of the derma ; the third is composed of small convex bodies, concave on their inner side, containing the colouring matter of the skin ; the fourth is white, of extreme tenuity, pierced by the hairs, and adherent to the epidermis.

3. *The epidermis, or cuticle.*—This is the most superficial layer, adherent to the fourth layer of the rete mucosum ; it is transparent and thin, and formed of numerous scales in close apposition with one another ; perforated by the numerous absorbent vessels and by the hairs, and varying in thickness in the various parts of the body. The skin receives nerves, and numerous vessels and lymphatics, and contains many small sebaceous follicles.

#### HAIRS AND NAILS.

The hairs are inorganic, filiform, insensible parts, varying in colour from a light blond to the deepest black, which are inserted in the free surface of the skin. They are found over nearly the whole surface of the body, but they are very numerous on the scull, on the superciliary ridges, at the loose edges of the eyelids, on the chin, around the genitals, in the axillæ. The palms of the hands and soles of the feet are entirely destitute of them.

The hairs are composed of two parts: 1st, That which projects from the surface of the skin, or the hair, properly so called, which is sometimes straight and sometimes curled ; 2d, The *bulb*, or secretory organ of the hair, which seems to be only a depression of the derma ; we find in the bulbs all the layers of this latter organ. A small cone of pulpy matter fills a great part of its cavity. On this body is inserted the hair, or inorganic part. The bulb presents, on the outside, twigs of nerves and bloodvessels. The base of the hair is hollow, and embraces the pulpy cone of the bulb ; the epidermis is reflected on it. The hair itself is only an epidermoid, colourless sheath, enclosing a coloured substance, arranged by filaments, united by a fluid material.

The nails are hard, semitransparent, whitish, inorganic laminæ, which cover the dorsal part of the last phalange of the toes and fingers. They are oblong, flattened, convex on the outside, concave on the inside. Their convex face is smooth, and presents posteriorly a white semilunar portion termed the *lunule*. Most of their concave face is attached; their root is situated in a fold of the skin, to which it is attached; their *free* extremity extends beyond the pulp of the fingers and toes. The nails adhere to the skin by the epidermis. This adhesion is particularly remarkable at their root, which is situated in a kind of groove of the derma. The nails are considered by Bichat and Meckel as formed of superimposed folds of the epidermis, and by Blainville as pilous productions arising from bulbs similar to those of the hairs.

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## ORDER IV.

### INTERNAL SENSITIVE APPARATUS.

The different parts of which it is composed are continuous with each other, and are termed the *encephalon*, sometimes the nervous centre, cerebro-spinal system, &c.

## ARTICLE I.

### ENCEPHALON.

[*Preparation.*—To remove the brain from the skull, make a circular incision around the head, passing over the forehead and occiput. The hairy scalp and the occipito-frontalis muscle are then elevated, the periosteum is then scraped, the skull is broken, and the skull-cap raised with a lever. The brain should be steeped several days in alcohol, either pure or mixed with one third of nitric acid. The upper region of the brain may be studied without displacing it, provided the membranes are carefully removed. In order to see its lower region, we remove it from the cranium, and turn it on its upper face. Its envelopes must be carefully detached.]

*Conformation.*—The encephalon is symmetrical and regular, and fills the cavities of the skull and spine. In the first it is very large, irregularly oval, broad posteriorly, and narrow anteriorly; in the second it is elongated and rounded. It is formed by four parts, viz., the cerebrum, cerebellum, annular protuberance, and spinal marrow; and it is enveloped by three membranes, which are, proceeding from without inward, the dura mater, the arachnoid membrane, and the pia mater.

#### OF THE BRAIN.

*Situation.*—It occupies most of the cavity of the skull, which it fills to the tentorium of the cerebellum.  
*Form.*—Ovoid, slightly compressed on the sides, convex and rounded superiorly, flat and irregular inferiorly, having its larger extremity posteriorly, presenting differences of conformation in its exterior and interior parts.

*Superior surface.*—This presents on the median line the deep longitudinal fissure occupied by the falx cerebri; bounded inferiorly and in the middle by the corpus callosum, which divides the brain anteriorly and posteriorly, and terminates at the centre in the corpus callosum. This fissure separates the brain into two parts, called hemispheres. These latter are convex on the outer side, flattened on the inner or commutual region, distinguished into the right and left, presenting two surfaces; the one, internal, is smooth and vertical, and in relation with that on the opposite side; the other, external and convex, presents the convolutions of the brain, eminences rounded on their borders, tortuous and undulated like the intestines, separated by the anfractuosities, which are depressions corresponding to the convolutions, and generally are about an inch in depth.

*Inferior surface.*—This presents on the median line, and from before backward, 1st, The inferior termination of the longitudinal fissure, which divides the anterior lobes; 2d, A membranous, transparent, and

slightly resisting portion, which closes in the bottom of the third ventricle, and extends from the antero-inferior part of the corpus callosum to the union of the optic nerves; 3d, The commissure of the optic nerves; 4th, A gray, quadrilateral substance, united anteriorly to these nerves, and posteriorly to the corpora mamillaria, and termed the *tuber cinereum*, which contributes to form the floor of the third ventricle; 5th, The pituitary sheath, a thin, reddish, conical prolongation, united superiorly to the preceding substance, continuous inferiorly with the pituitary gland; 6th, The *pituitary gland*, a rounded body, elongated transversely, gray exteriorly, yellowish interiorly, lodged in the pituitary fossa of the sphenoid bone, surrounded by the dura mater, except superiorly, where it is covered by the arachnoid membrane; 7th, The *corpora mamillaria*, or *albicantia*, two white eminences of the size of a small pea, corresponding to a part of the floor of the third ventricle, situated behind the gray body just mentioned; 8th, A triangular cavity, placed behind these bodies, between the crura cerebri, which are united by a medullary portion, which also concurs to form a part of the inferior parietes of the third ventricle; 9th, The *pons varolii*, which will be described hereafter; 10th, A considerable vertical fissure, situated behind the pons varolii, terminating posteriorly the longitudinal fissure, separating the posterior lobes; 11th, Another fissure, placed between the posterior extremity of the corpus callosum and posterior surface of the pons varolii, by which the pia mater penetrates into the third ventricle; 12th, Two other lateral fissures, one on each side, continuous with the preceding, semicircular, situated between the corpora fimbriata and the thalami optici, traversed by the pia mater, which extends into the lateral ventricles.

On each side of the median line the inferior surface of the brain is divided into three lobes; proceeding from before backward, we observe, 1st, The *anterior lobe*, triangular, marked by a depression for the olfactory nerve of that side, and resting upon the or-

bital surface of the frontal bone ; 2d, The *middle lobe*, prominent, rounded, occupying the middle and lateral fossæ of the base of the cranium, separated from the anterior lobe by the fissura Sylvii, which is a deep depression, directed outward and forward, corresponding to the posterior border of the wing of Ingratias, and continuous on the inner side with a fissure, by which the pia mater enters the lateral ventricles ; 3d, Another longitudinal fissure, bounded on the outside by the middle lobe, by the anterior prolongation of the protuberance on the inside ; 4th, The *posterior lobe*, separated from the middle by a slight depression, and resting on the tentorium cerebelli.

#### INTERIOR OF THE BRAIN.

The objects here observed are situated either between the hemispheres or in their thickness.

#### OBJECTS SITUATED BETWEEN THE TWO HEMISPHERES.

These are, proceeding from above downward, the corpus callosum, the septum lucidum, the fornix, the pineal gland, and the third ventricle.

[*Preparation.*—To see the corpus callosum, remove the hemispheres by a horizontal cut as far as this organ. The septum is seen by making a vertical incision from before backward and from below upward, which passes through the cerebrum, the annular protuberance, the medulla oblongata, and the cerebellum. To see the fornix and the ventricles, we separate the corpus callosum from the hemispheres by cutting their sides, and turn it back from them.]

1. *The corpus callosum.*—A broad band of medullary substance, quadrilateral, lying horizontally, and turned on itself anteriorly and posteriorly. Its *superior face* is covered by the hemispheres, and traversed by a line of denser appearance than the rest, running in the median direction, and termed the raphe, on each side of which lies a longitudinal groove for the passage of the artery of the corpus callosum. Its *inferior face* contributes laterally to form the superior wall of the lateral ventricles ; in the middle it covers

the fornix, and is continuous with it posteriorly; it adheres on the median line, and in its two anterior thirds, to the septum lucidum. Its *posterior extremity* is blended with the fornix, and is continuous laterally with the pes hippocampi. Its *anterior extremity* is curved from above downward and from before backward, as far as the base of the brain; embraces the anterior part of the corpora striata, and forms the anterior part of the floor of the lateral ventricles. Its *lateral borders* are blended with the medullary substance of the brain.

2. *The septum lucidum.*—This is a vertical, triangular plate, flattened transversely, in relation laterally with the corpora striata and optic beds, continuous superiorly with the inferior face of the corpus callosum; united by its infero-posterior part to the fornix; by its infero-anterior to the anterior curved portion of the corpus callosum; anteriorly to the body of the corpus callosum; it is formed of two plates of white substance, separated by a small cavity, termed the ventricle of the septum, and which is lined by the arachnoid membrane.

3. *The fornix.*—A medullary, horizontal, triangular plate, situated beneath the septum and the corpus callosum. Its *superior face*, contiguous with the corpus callosum, is united on the median line to the septum of the ventricles. Its *inferior face* is applied on the choroid membrane and thalami optici, and presents posteriorly a few more or less oblique striæ, termed the lyra. Its *anterior extremity* forms the anterior pillar, and is divided into two medullary cords, separating from one another, curved from above downward, behind the anterior commissure, terminating in the corpora mamillaria; behind each of these cords exists an oval opening, which forms the communication between the third and lateral ventricles, and is termed the foramen Monroianum. *Posterior angles.*—They form the posterior pillars of the fornix, each furnishing a medullary prolongation, termed the corpus fimbriatum, which is a long, flattened band, prolonged into the bottom of the lateral ven-

tricle, winding round the concave border of the cornu ammonis.

4. *The pineal gland.*—A small, irregular, grayish body, situated beneath and behind the fornix, of the size of a small pea, embraced by the pia mater, isolated from the cerebral substance, except anteriorly, where it is united to the thalami optici by two small medullary pedicles, which proceed from the supero-internal part of these latter; this body generally contains a number of hard, transparent little grains.

5. *The third ventricle.*—A horizontal cavity, elongated from before backward, placed between the thalami optici, bounded superiorly by the choroid plexus and fornix; inferiorly by a thin plate, which separates it from the base of the brain; laterally by the thalami optici, which are united by the commissura mollis; anteriorly by the anterior commissure, being a transverse, rounded, medullary band, which passes from one hemisphere to the other, and beneath which lies the vulva; posteriorly by the posterior commissure, similar to the preceding, but thicker and shorter; beneath it lies the anus, being the anterior orifice of the aqueduct of Sylvius.

Those parts situated in the hemispheres are,

*The lateral ventricles.*—Two considerable cavities, elongated from before backward, curved on themselves, commencing about an inch and a half from the anterior extremity of the cerebrum; separating from one another anteriorly and posteriorly, they are directed downward, outward, and forward, and terminate near the fissure of Sylvius; their superior portion is bounded superiorly by the corpus callosum; inferiorly by different eminences afterward to be mentioned; on the inner side by the septum lucidum; and anteriorly by the curved portion of the corpus callosum; posteriorly it presents the digital cavity formed in the posterior lobe, and presenting a small eminence, termed the hippocampus minor; the inferior part of the ventricles is hollowed in the posterior lobe.

The upper portion of the lateral ventricles presents



the corpora striata, the thalami optici, the tenia semicircularis.

1. *Corpora striata*.—Two pyriform, grayish eminences, prominent and free anteriorly, on the inner side, and superiorly; contiguous in the latter direction with the corpus callosum; continuous all around with the cerebral substance; exteriorly of a grayish brown appearance.

2. *Thalami nervorum opticorum*.—Medullary bodies, placed behind the preceding, voluminous, rounded, corresponding to the lateral and third ventricles, and to the exterior of the brain, confounded on the outer side with the substance of the brain and corpora striata; their superior face forms a part of the floor of the lateral ventricles; their inferior presents on the outer side two enlargements, termed the corpora geniculata, which send a few filaments to the optic nerves; their internal face corresponds to the third ventricle, forming its lateral walls; united anteriorly by the commissura mollis; their anterior extremity contributes to form the opening of communication of the lateral and third ventricles; the posterior is free, and contiguous to the corpora fimbriata.

3. *Tenia semicircularis geminum*.—A species of medullary, delicate, transparent band, placed between the corpora striata and thalami optici; directed backward, it gradually contracts, and is lost towards the corpus geniculatum externum.

The inferior part of the lateral ventricles contains, 1st, The corpora fimbriata, already described. 2d, The cornua ammonis, medullary prolongations, concave anteriorly, convex posteriorly, covered superiorly by the choroid plexus, and by the corpora fimbriata at their concave border, terminating by a bulbous extremity, on which are placed two or three small tubercles, separated by slight depressions.

#### OF THE CEREBELLUM.

*Situation*.—In the inferior occipital fossæ, and its volume is one fourth of the cerebrum. *Form*.—



Regular, symmetric, a little flattened from above downward and convex, circumscribed by an elliptical curve; continuous anteriorly with the brain and medulla oblongata by means of the pons varolii; presenting on its surface an immense number of convolutions, divided into two hemispheres by a fissure.

*Superior face.*—This is flattened and slightly convex, and presents on the median line a slight prominence, termed the *processus vermiformis superior*, and laterally two plane portions, covered by the tentorium cerebelli. *Inferior face.*—This presents, 1st, In the middle, a deep depression, which lodges anteriorly the origin of the spinal marrow, and which is divided into two parts posteriorly by a voluminous eminence, the *processus vermiformis inferior*. This eminence is composed of numerous parallel and transverse folds. 2d, Laterally, two convex surfaces received into the inferior occipital fossæ, in each of which we distinguish four lobules.

*Circumference of the cerebellum.*—Fissured anteriorly to receive a part of the annular protuberance, which is continuous with it by the posterior prolongations: it presents in this direction, between the protuberance and the inferior face of the cerebellum, a cavity, which corresponds to the aqueduct of Sylvius, and presents posteriorly a triangular fissure, occupied by the falx cerebelli.

#### PONS VAROLII.

*Situation.*—In the middle of the base of the brain, between the cerebrum and cerebellum, with which it is continuous. *Exterior form.*—Quadrilateral, directed downward and backward, nearly as thick as broad. Its inferior face rests on the basilar groove; presenting on the median line a groove for the passage of the basilar artery. Its superior face is situated behind the middle ventricle of the cerebrum, and is almost entirely concealed by the fissure of the circumference of the cerebellum. It presents, 1st, The *tubercula quadrigemina*.—Four white rounded eminences, gray in their interior, separated by two grooves, which divide

them into the superior pair, the largest named the *nates*, and into the inferior pair, the *testes*; these bodies are situated immediately behind the posterior commissure; the pineal gland corresponds to the point of section of the two grooves. 2d, Behind the tubercula quadrigemina lies the *valve of Vieussens*, or of the aqueduct of Sylvius; it is formed of a pulpy, thin, gray plate, mounting towards the cerebellum, is continuous on each side with the two medullary plates coming from the *testes*, and shutting in, superiorly, the fourth ventricle. The anterior edge of the pons varolii is separated from the brain by a circular depression; its posterior, from the medulla oblongata by a deep groove; the lateral edges are thick and round, and united to the peduncles of the cerebellum.

Interiorly, the pons varolii presents the *aqueduct of Sylvius*, a narrow passage forming the communication between the third and fourth ventricles, and commencing beneath the posterior commissure, directed obliquely backward and downward. *The fourth ventricle*.—This is a broad cavity, directed obliquely downward and backward; its anterior wall is formed by the pons varolii, and presents the *calamus scriptorius*, on the sides of which we observe some narrow white striæ; the superior of these sometimes proceed to the acoustic nerve, the middle and inferior generally go to the cerebellum; its lateral walls are bounded by the prolongations which come from the tubercula quadrigemina; its posterior wall is short, and formed by a part of the anterior notch of the cerebellum; its superior extremity is closed in by the valve of Vieussens; the inferior forms a cul-de-sac at the commencement of the spinal marrow.

*Prolongations of the pons varolii*.—Of these there are four; two anterior and two posterior. The *anterior* are short, elongated, and rounded. They are near one another at their origin; they then separate, and proceed forward, upward, and outward from the anterior angles of the protuberance to the lower and central part of the cerebrum, where they blend with the substance of the thalami optici.

The *posterior* prolongations are more distinct from one another at their origin than the preceding, and are directed backward and outward; they go from the lateral edges and posterior angles to the hemispheres of the cerebellum, of which they form the medullary centres.

#### THE MEDULLA OBLONGATA ET SPINALIS.

*Medulla oblongata*.—Contained in the cranium, extending from the pons varolii to the occipital foramen; contiguous superiorly with the pons varolii, presenting anteriorly four eminences, two internal, termed *corpora pyramidalia*, and two external, termed *olivaria*; oblong, separated from the preceding by a groove, from whence proceed the filaments of the hypo-glossal nerve; on either side of the posterior surface of the medulla oblongata, we observe the *corpora restiformia*.

*Medulla spinalis*.—A large, long, cylindrical cord, extending downward as far as the middle of the body of the first or second lumbar vertebra; its anterior surface corresponds to the bodies of the vertebræ, presents numerous transverse grooves, and is divided into two portions in its whole length by a median depression. Its posterior surface is also divided by a fissure into two parts; its lateral surfaces, rounded, give origin, near its anterior and posterior surfaces, to the vertebral nerves; its inferior extremity presents two enlargements, one superior, ovoid, and the most voluminous; the other inferior, smaller, and conical.

#### ORGANIZATION OF THE BRAIN AND SPINAL MARROW.

*The brain*.—Two substances enter into the structure of this organ; one exterior, soft, spongy, and gray, termed the cortical substance; the other interior, white, more firm and dense, termed the medullary. The cortical substance receives a considerable quantity of bloodvessels, is of a rosy colour in the infant, and of an ashy colour in old age; it appears

composed of an immense quantity of globules, which are one eighth the size of those of the blood. The medullary substance is more abundant, occupies principally the interior and base of the brain, and in some parts is intermixed with the cortical substance ; it is generally considered to be of a fibrous structure.

*Spinal marrow.*—The medulla is less consistent than the other parts of the encephalon. Exteriorly, the spinal marrow presents a layer of white substance, more or less pulpy, about half a line thick, and containing in its centre a portion of gray matter, which is found more abundant as the subject is younger. This gray matter may be divided into a middle and two lateral portions ; the first is transverse, thicker and broader in the neck, more delicate in the dorsal region, and becomes again more voluminous, but not broader, in the lumbar region. The two lateral portions are curved, so that their convexities look towards one another, while their concavities are turned outward ; these two portions are well marked in the superior part of the neck ; they afterward diminish as far as the inferior parts of the dorsal region, where they manifestly enlarge.

#### OF THE MEMBRANES OF THE BRAIN.

##### DURA MATER.

[*Preparation.*—We make in the arch of the skull, with a saw, two sections on each side, one horizontal, the other vertical, falling one on the other, so as to allow us to remove the two lateral portions, preserving on the median line an osseous arch eight or ten lines broad. We then cut the dura mater on one side, and remove from the skull the mass of the brain ; we then can see the falx of the dura mater, &c.]

*General arrangement.*—The dura mater is a fibrous membrane, dense, thick, of a pearly-white colour, occupying the interior of the cranium and vertebral canal, forming the most exterior envelope of the brain. Its exterior surface in the area of the skull adheres intimately to the sutures ; in the base of the skull it embraces the crista galli of the ethmoid bone,

furnishes fibrous canals to the foramina of the cribiform plate, and to the foramina orbitaria interna, giving an envelope to the optic nerves, the external plate of which meets the periosteum of the orbit, and the internal blends with the sclerotica. It is pierced by the internal carotid artery, behind the optic foramen, and lines the pituitary fossa, where it is separated by the pituitary gland from the arachnoid membrane; it is divided into two plates, which embrace the cavernous sinus; it forms a small fold on the border of the wing of Ingrassias; gives an envelope to the superior and inferior maxillary nerves and middle meningeal artery; it enters into the internal auditory foramen, and gives particular envelopes to most of the nerves and internal jugular vein. In the vertebral canal it is separated from the vertebræ by cellular tissue of a rosy colour, except anteriorly, where it is united to the posterior vertebral ligament; it is fixed at its termination to the sacrum and os coccygis, by five ligamentous filaments. The internal surface of the dura mater is covered in its whole extent by the arachnoid membrane. It gives origin to three principal folds, viz: 1st, *The falx cerebri*.—A species of fibrous plate, falciform, broad posteriorly, narrow anteriorly, vertical, occupying the longitudinal fissure. *Superior border*.—Convex, corresponding to the sagittal suture, and to the middle groove of the occipital bone. *Inferior border*.—Concave, placed above the corpus callosum. *Anterior extremity*.—Fixed to the crista galli. *Posterior extremity*.—Continuous with the tentorium cerebelli.

2d, *Tentorium cerebelli*.—A species of fibrous roof, supporting the posterior lobes of the brain; in relation, inferiorly, with the cerebellum; united by its greater circumference, which is convex, to the superior border of the petrous portion of the temporal bone; corresponding by its lesser circumference to the pons varolii; terminating anteriorly by two bifurcated extremities, which are fixed to the clinoid processes.

3d, *Falx cerebelli*.—A small triangular plate, extend-

ing from the internal occipital protuberance to the occipital foramen, placed between the hemispheres of the cerebellum, continuous by its base with the tentorium cerebelli, bifurcated at its summit. *Organization of the dura mater.*—This membrane, of a fibrous nature, presents, in different parts of its tissue, venous canals, termed sinuses of the dura mater, which are lined by the inner membrane of the veins.

1st, *Torcular herophili.*—This is an irregular cavity, placed at the union of the three great folds of the dura mater, in front of the internal occipital protuberance; it is lined by the internal membrane of the veins, and presents six openings; one superior, triangular, that of the superior longitudinal sinus; two inferior, varying in form and breadth, corresponding to the occipital sinuses; one anterior, rounded, belonging to the straight sinus; lastly, two lateral ones, very broad, varying in size on the right and left side, and leading into the lateral sinuses.

2d, *Superior longitudinal sinus.*—Triangular, narrow anteriorly, broader posteriorly, occupying the superior border of the falx cerebri; commencing in front of the crista galli process by a cul-de-sac; receiving the frontal veins, those of the bones of the roof of the cranium, all those of the surface of the hemispheres, which last are provided with a small valve at their opening.

3d, *Inferior longitudinal sinus.*—Much narrower than the preceding, situated at the inferior border of the falx, from its anterior third as far as the tentorium cerebelli, terminating posteriorly, by two branches, in the straight sinus.

4th, *Straight sinus.*—Triangular, broader posteriorly than anteriorly, occupying the base of the falx, above the tentorium cerebelli, extending from the termination of the preceding sinus as far as the torcular herophili; receiving the venæ Galen and the superior cerebellic veins.

5th, *Occipital sinus.*—Narrow, placed in the thickness of the falx cerebelli, on the sides of the occipital foramen, opening into the inferior part of the tor-

cular herophili, receiving the veins of the falx, and those of the neighbouring portion of the dura mater.

6th, *Lateral sinuses*.—Very vast, triangular, extending from the torcular herophili to the commencement of the jugular vein, occupying the lateral groove at the base of the cranium, receiving some veins from the cerebellum, posterior lobes of the brain, and tentorium cerebelli; presenting anteriorly the orifices of the superior and inferior petrous sinuses, communicating by the mastoid and posterior condyloid foramina with the occipital veins.

7th, *Coronary sinus*.—Very narrow, placed behind the groove of the optic nerves, in front of the quadrilateral plate of the sphenoid bone, on the pituitary gland; opening by its extremities into the cavernous sinus.

8th, *Cavernous sinus*.—Very broad, short, lodged in the lateral grooves of the body of the sphenoid bone, between the two plates of the dura mater; commencing beneath the posterior clinoid processes; terminating in the space which separates the summit of the petrous portion of the temporal bone from the quadrilateral plate of the sphenoid, opening in this place into the superior and inferior petrous sinuses; containing the internal carotid artery and third pair of nerves, which are separated from the blood by the internal membrane of the veins; formed by two plates, one internal, covering the osseous surface, the other external, containing in its thickness the third pair of nerves, the fourth, and ophthalmic branch of the fifth, communicating with one another beneath the pituitary gland by a small vein.

9th, *Superior petrous sinuses*.—Triangular, situated in a part of the circumference of the tentorium cerebelli, on the superior border of the petrous portion of the temporal bone; extending from the cavernous sinus to the lateral sinuses, into which they open.

10th, *Inferior petrous sinus*.—Placed between the inferior border of the petrous portion of the temporal bone and basilar process; arising from the cavernous sinus together with the preceding, with which they



communicate, and opening into the lateral sinuses on a level with the commencement of the internal jugular veins.

11th, *Transverse sinus*.—Very broad, situated transversely at the superior part of the basilar process, forming the communication between the petrous and cavernous sinuses on both sides.

#### PIA MATER.

*General disposition*.—A cellulo-vascular membrane, covering the brain on all sides, dipping into the anfractuositities of the hemispheres, and extending into its internal cavities. *External pia mater*.—It lines superiorly the circumvolutions of the cerebral hemispheres, and the upper surface of the corpus callosum; covering inferiorly the base of the brain, and the inferior pons varolii; disappearing towards the commencement of the spinal marrow, and directed towards the cerebellum, which it covers entirely, dipping into its grooves. Its exterior surface is adherent to the arachnoid membrane, on a level with the convolutions, and separates from this membrane in the anfractuositities. Its interior surface is immediately applied on the cerebral substance. The pia mater penetrates into the third and lateral ventricles of the brain by the great fissure placed between the posterior extremity of the corpus callosum and pons varolii, and by the two lateral fissures, and forms, 1st, The choroid membrane, a triangular prolongation, situated in the third ventricle, covering the inferior surface of the fornix, presenting inferiorly and posteriorly the orifice of the arachnoid canal, above the pineal gland, continuous anteriorly and on the side with the choroid plexus; 2d, The choroid plexus, an elongated fold, situated in the lateral ventricles, along the borders of the fornix and corpus fimbriatum, continuous on the inner and anterior side with the choroid membrane, terminating at the extremity of the ventricles, where they communicate with the exterior pia mater.



## ARACHNOID MEMBRANE.

*General disposition.*—A very thin and transparent serous membrane, placed between the pia mater and dura mater, forming a sac without an opening, covering the surface of the brain and the internal surface of the dura mater, and passing into the interior of the former. The exterior arachnoid covers superiorly the convexity of the hemispheres without penetrating into the anfractuositities; it lines their internal surface and the corpus callosum, forming sheaths for the veins; it covers posteriorly the posterior lobes of the brain, the superior and inferior surfaces, and circumference of the cerebellum; is reflected on the veins of the sinuses; covers, anteriorly, the anterior lobes of the brain, passing from one to the other without dipping into the fissures which separate them, and the whole base of the brain and inferior surface of the pons varolii; it gives to the arteries, veins, and nerves which come off, sheaths, which are reflected on the dura mater; it passes backward and downward into the vertebral canal, around the spinal marrow, to which it is but slightly adherent; it furnishes, on the sides of the spinal marrow, a conical sheath for each of the vertebral nerves; it forms a cul-de-sac at the extremity of the spinal marrow, and is reflected on the dura mater to line entirely its internal surface, both there and in the cranium. The interior arachnoid is continuous with the preceding, penetrating into the third ventricle by a narrow oval opening, placed between the corpus callosum and tubercula quadrigemina; lining the third ventricle, the choroid plexus, the lateral and fourth ventricles, into which latter it passes through the aqueduct of Sylvius. The glands of Pacchioni are hard yellowish or whitish little bodies, existing distinctly or in bunches; their nature is peculiar and unknown, and they abound in the superior longitudinal sinus, covered by its inner membrane; a few are found at the confluence of the sinuses, in the right sinus, in the external pia

mater, and along the great fissure in the plexus choroideus and the tela chorioidea.

*The proper membrane of the spinal marrow* is distinct from the pia mater; it is formed of a strong, resisting tissue, of a yellowish-white colour, corresponding by its external surface to the arachnoid, without uniting with it, and continuous laterally with the neurilemma of the vertebral nerves and ligamentum denticulatum; it adheres intimately by its internal surface to the spinal marrow.

*The ligamentum denticulatum.*—A whitish, transparent band, passing on each side between the anterior and posterior roots of the vertebral nerves, from the occipital foramen as far as the extremity of the spinal marrow; presenting on its external border twenty or twenty-two denticulated portions, the points of which, more or less elongated, are fixed to the dura mater, in the interval of each cervical and dorsal pair of nerves; adhering by its internal border to the proper membrane of the spinal marrow.

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## ORDER V.

### NERVOUS APPARATUS.

THE nerves are grayish white cords, of a moderate degree of consistence, formed by distinct filaments, which are attached by one extremity to the grand nervous centre (the encephalon), or to small particular centres, termed ganglia, and at the other end ramify in the organs and are lost. The nerves are divided, according to their functions, into two classes, viz. : 1. The *encephalic*, or *cerebro-spinal* nerves, which serve to transmit to the brain impressions of external objects, and to convey voluntary motion to the organs of locomotion. 2. The *ganglionic* nerves, the functions of which, although little known, seem connected with the exercise of the organs of nutritive life.

## OF THE ENCEPHALIC NERVES GENERALLY.

*Situation.*—These nerves all spring from one of the divisions of the encephalon, the cerebrum, cerebral protuberance, and the spinal marrow. Their central extremity is situated in the cavities of the skull and spine. They ramify in proportion as they approach the surface. *Conformation.*—The nerves, considered as a whole, present, from their numerous communications, the form of a network of two symmetrical halves. Most of them are round, but some are flat. Their external surface, when seen by the microscope, shows small transverse folds. Their central extremity, improperly termed their origin, is connected with the encephalon, in which they can be traced farther than the point of their departure from it. This insertion takes place in the gray substance. The central extremity of the nerve is termed the root. This root is single or double. *Course.*—As the nerves proceed from the nervous centre, they are divided successively into branches, twigs, and filaments, by the separation of the filaments which unite to form the trunk. In the course of their progress to the different organs, the nerves often unite, either with each other or with adjacent nerves, by anastomoses, or by a kind of more or less complex interlacing, which is termed plexus. *Peripheral extremity, or termination.*—The encephalic, or cerebro-spinal nerves, terminate, after more or less numerous ramifications, in the skin, the organs of sense, the voluntary muscles, the arteries which are distributed to the organs of relative life, &c. At their last perceptible division, the nervous fasciculi are deprived of their external coat, and evidently enlarge. *Organization.*—The nerves are composed of a great number of very thin filaments, united by cellular tissue, which is easily separated. Each filament is composed of white nervous substance, arranged in parallel fibres, and in a sheath or membranous envelope, termed the *neurilemma*. Besides their special neurilemma, all the filaments of the nerves have a common neurilemma,

which envelops the trunk; but at their central extremity this envelope is deficient. The neurilemma seems formed of condensed cellular tissue.

*Vital properties and functions.*—The nerves are conductors of motion and of sensation. They transmit to the encephalon the impressions they receive in the organs to which they are distributed, and by a contrary action, transmit to these organs the nervous influence from the nervous centre, which produces voluntary contractions in the muscles. During the exercise of their functions, neither vibration nor oscillation can be observed in them, although some facts tend to show the existence of an imponderable fluid circulating in the nerves, and producing different kinds of nervous phenomena. The nerves are divided into nerves of motion, which are designed exclusively to transmit motion, nerves of sensation, which are the seat of the sensations, and mixed nerves, which fulfil both these functions at the same time. Under the first two classes are included all the nerves of the cranium except those of the fifth pair, and the last embraces the fifth pair and all the spinal nerves. Bell and Magendie have demonstrated, by numerous experiments, that the interior roots of the spinal nerves preside over motion, and the posterior over sensation. Some pathological facts, however, render this doubtful. Bell thinks, from numerous dissections in the living subject, that all the nerves with two roots serve for general sensibility and voluntary motion, which are all the spinal nerves, including the sub-occipital and the fifth pair; and that, on the contrary, those with one root preside over a single function.

#### NERVOUS SYSTEM OF THE GANGLIONS GENERALLY.

Bichat and the principal modern physiologists regard the nervous system of the ganglions as a series of small nervous systems, more or less independent, each having a special centre, termed *ganglion*; and among the nerves which proceed from them, some go to the principal organs of nutritive life, others

communicate either with nerves of the same character or with the encephalic nerves. According to other anatomists, the nerves and ganglions form a single nervous system, connected in all its parts, termed the great sympathetic nerve, the great intercostal nerve, the trisplanchnic nerve.

1. *Nervous ganglions*.—The ganglions are small rounded, or long nervous masses, of a grayish-red colour, situated in the course of the nerves. They are divided into two species; those which belong to the encephalic nerves, and those which make part of the great sympathetic nerve. They are situated exclusively in the head, neck, chest, and abdomen. Those of the first kind are found near the origin of some of the cranial and all the vertebral nerves. They belong only to the posterior roots of these latter. Nearly all the ganglions of the great sympathetic nerve are situated on the sides of the anterior face of the vertebral column, extending from the head to the coccyx. Two are situated nearer the median line; these are the cardiac and semilunar ganglions. *Formation*.—Most of the vertebral ganglions are oval; others are rounded, globular, oblong, &c.; they are from the size of a bean to that of an almond. *Structure*.—The ganglions, although homogeneous at first view, are composed of two substances, rendered distinct by maceration; one white or medullary, arranged like the nerves, in filaments; the other of a grayish-red, pulpy, differing from the cortical substance of the encephalon, and arranged in a kind of cellular tissue. The medullary filaments of this white substance are the continuation of the nerves on the course of which the ganglions are placed. These organs are enveloped in a more or less dense membrane. They receive many nerves. *Functions*.—Of these but little is known, and authors differ on the subject. The most generally received opinion is that of Vieussens, Reil, Bichat, &c., who regard them as nervous centres presiding over involuntary innervation, that which is necessary to the nutritive functions. We are com-

pletely ignorant of the uses of the ganglions belonging to the cranial and vertebral nerves.

2. *Ganglionic nerves*.—By this term we understand those nerves which, with the ganglions to which they are united, form small nervous systems, communicating with each other and with the spinal nerves by intermediate branches; they are distributed to the principal organs of sensitive life. They are divided into three kinds: 1st, Those which establish the communication between the ganglions; 2d, Those communicating with these ganglions and the encephalic nerves; 3d, Those which ramify in the organs. They are situated, like the ganglions, in the head, neck, chest, and abdomen. Their form is irregular, some being flat, others rounded, &c.; and, taken as a whole, they are not so symmetrical as the encephalic nerves. One extremity of these nerves is connected with the ganglions, and is continuous with its medullary filaments. The ganglionic nerves of the first two species communicate with the ganglions, or with the encephalo-rachidian nerves, but present nothing remarkable. Some of those of the third kind ramify in the tissue of the nutritive organs; others probably form plexuses, or more or less complex interlacings. Most of their twigs unite with those of the cerebro-spinal nerves. The ganglionic nerves terminate in the plexures of the arteries of the trunk, in the heart, in the digestive canal and its appendages, and in the genital and urinary organs. The ganglionic nerves of the first two classes are composed of small medullary fibres, surrounded with gray substance, which contributes to compose the ganglions, and covered with a neurilemma, which is intimately united to them. The nerves of the third kind are formed of a reddish and soft pulp, and have no apparent neurilemmatic envelope. *Vital properties and functions*.—The nervous power which resides in and is transmitted by these nerves is manifested neither by sensibility nor by contractions; it consists essentially in the degree of innervation necessary to the nutritive functions over which these nerves preside. It is probably

to the ganglionic nerves that we must ascribe, 1st, In the healthy state, the involuntary contractions of the heart and digestive system, as also all the motions of molecules required by the secretions, the exhalations, and the different assimilations; 2d, In diseases, the different sympathetic phenomena manifested in the organization.

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## NEUROLOGY :

### OR, DESCRIPTION OF THE NERVES IN DETAIL.

#### OF THE ENCEPHALIC NERVES.

THEY are divided into the nerves which emerge from the foramina at the base of the skull, or cranial nerves, and into nerves which emerge through the foramina of the vertebral canal and sacrum, or the vertebral nerves.

#### TABLE OF THE NERVES.

The following table presents a methodical distribution of the nerves which serve to transmit to the brain the impressions of exterior objects, and of those which serve to conduct the locomotive organs.

##### CRANIAL NERVES. (12.)

- |                                    |   |   |
|------------------------------------|---|---|
| 1. Olfactory nerve.<br>First Pair. | { | Divided into <i>internal</i> , <i>external</i> , and <i>middle</i> branches, which are distributed to the pituitary membrane.           |
| 2. Optic nerve.<br>Second pair.    |   | Terminates in the eye.  |
| 3. Third pair.                     | { | <i>Superior branch</i> .—To the superior rectus muscle of the eye, and to the levator palpebræ superioris.                              |
|                                    |   | <i>Inferior branch</i> .—To the rectus internus, rectus inferior, and obliquus of the eye; a filament going to the lenticular ganglion. |
| 4. Fourth pair.                    | { | To the obliquus superior muscle of the eye.   |



- 1st. *Ophthalmic branch*.—Divided into three twigs ; 1st, *Lachrymal*, to the lachrymal gland and superior eyelid ; 2d, *Frontal*, to the forehead and superior eyelid ; 3d, *Nasal*, to the eyelids, nasal fossæ, and nose.
- Superior maxillary branch*.—1st, *Orbital twig*, in the orbit ; 2d, *Posterior and superior dental twigs*, to the incisor, to the canine, and two small molar teeth ; 4th, *Infra-orbital branches*, to the upper lip, cheek, and nose.
- 2d. *Inferior maxillary branch*.—1st, *Deep temporal twigs*, to the temporalis muscle ; 2d, *Masseteric twig*, to the masseter muscle ; 3d, *Buccal*, to the internal surface of the cheek ; 4th, *Pterygoid*, to the internal pterygoid muscle ; 5th, *Lingual*, to the mucous membrane of the tongue ; 6th, *Inferior dental*, to the teeth of the lower jaw and to the lip ; 7th, *Auricular*, to the pavilion and front part of the ear.
- To the external rectus muscle of the eye.
- 1st. At its exit from the cranium, the *posterior auricular*, *stylo-hyoidean*, and *sub-mastoid twigs*, to the pavilion of the ear, to the mastoid process, to the digastricus, and to the muscles which are attached to the styloid process.
- 2d. Beyond the parotid gland, the *temporal*, *malar*, *buccal*, *supra-maxillary*, *infra-maxillary twigs*, to the whole surface of the face.
- To the vestibulum, semicircular canals and cochlea.
- To the base of the tongue and pharynx.
- 1st. In the neck, *Pharyngeal twig*, to the pharynx ; *Superior laryngeal*, to the larynx and some of the muscles of the inferior hyoidean region ; *Cardiac*, to the cardiac plexus.
- 2d. In the thorax, *Inferior laryngeal* or *recurrent*, to the larynx ; *Pulmonary twigs*, which form the pulmonary plexus ; *Œsophagean twigs*, to the œsophagus.
- 3d. In the abdomen, *Gastric twigs*, to the parietes of the stomach ; some filaments which join the neighbouring plexus.



- |                                   |   |  |  |
|-----------------------------------|---|--|--|
| 11. Nervus accessorius of Willis. | { | At its exit from the cranium, a <i>small twig</i> , which anastomoses with the par vagum; in the neck, filaments to the trapezius and sterno-mastoideus. |  |
| 12. Hypoglossal nerve.            |   | {  | <i>Descending cervical branch</i> , or <i>descendens noni</i> , to the muscles of the inferior hyoid region, and with the cervical nerves; terminating in the muscles of the tongue. |
| Ninth pair.                       |   |  |  |

CERVICAL NERVES. (31 pairs.)

- |                              |   |  |  |
|------------------------------|---|--|--|
| 1. First pair.               | { | <i>Anterior branch</i> .—Anastomoses with the second pair. |  |
| 2. Second pair.              |   | {  | <i>Anterior branch</i> .—Anastomoses with the first pair, and concurs by another twig to form the cervical plexus. |
| 3, 4. Third and fourth pair. |   |  | <i>Anterior branch</i> .—Concurs in the formation of the cervical plexus.  |

The posterior branches of these four pair ramify in the muscles of the occipital and cervical regions.

- |  |   |   |
|--|---|---|
| Cervical plexus.                                 | { | <i>Descending branches</i> .—1st, <i>Internal descending</i> , anastomoses with a branch of the ninth; 2d, <i>Phrenic branch</i> , to the diaphragm; 3d, <i>External descending</i> , divided into supra-clavicular, supra-scapular, sub-clavicular, and deep cervical, to the muscles and integuments of the superior part of the chest and shoulder, to the trapezius, levator scapulæ and rhomboideus muscles, &c. |
|  |   | <i>Ascending branches</i> .—1st, <i>Mastoid branch</i> , to the postero-lateral part of the head, to the internal surface of the pavilion of the ear; 2d, <i>Auricular branch</i> , to the parotid gland and pavilion of the ear.   |
|  |   | <i>Superficial cervical branches</i> .—To the platysma myoides, digastricus, and integuments of the neck, etc.  |
| Fifth, sixth, seventh, and eighth cervical pair. | { | <i>Anterior branches</i> .—Concurring to form the brachial plexus.  |
| Brachial plexus.                                 |   | <i>Posterior branches</i> .—To the muscles and integuments of the posterior part of the neck and superior part of the back.   |
|  |   | {   |

Brachial plexus.	{	dorsal surfaces of the fore-arm, near the border of the ulna ; 5th, <i>External cutaneous</i> , principally to the integuments of the dorsal and palmar surfaces of the fore-arm, near the border of the radius ; 6th, <i>Median</i> , to the fore-arm, hand, and palmar face of all the fingers ; 7th, <i>Cubital</i> , or <i>ulnar</i> , to the last two fingers ; 8th, <i>Radial</i> , to the first three fingers ; 9th, <i>Circumflex</i> , around the articulation of the humerus with the scapula, and to the neighbouring muscles.
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## DORSAL NERVES.

1st Dorsal pair.	{	<i>Anterior branch</i> .—To the brachial plexus.
2d and 3d Dorsal pair.	{	<i>Anterior branches</i> .—An intercostal and a brachial twig.
4th, 5th, 6th, and 7th Dorsal pair.	{	<i>Anterior branches</i> .— <i>Internal twigs</i> , to the intercostal muscles, triangularis sterni, and pectoralis major, and to the skin ; <i>External twigs</i> , to the integuments of the chest, to the obliquus abdominis externus muscle, and to the skin of the abdomen.
8th, 9th, 10th, and 11th Dorsal pair.	{	<i>Anterior branches</i> .— <i>Internal twigs</i> , to the transversalis, obliquus internus, and rectus abdominis muscles, and to the skin of the abdomen ; <i>external twigs</i> , to the integuments of the chest, to the muscles and skin of the abdomen.
12th Dorsal pair.	{	<i>Anterior branch</i> .—To the first lumbar nerve, to the muscles and skin of the abdomen, as far as the crest of the ilium.

The posterior branches of the dorsal nerves are distributed to the muscles and integuments of the back and loins,

## LUMBAR NERVES.

1st, 2d, 3d, and 4th Lumbar pair.	{	<i>Anterior branches</i> .—Concurring in the formation of the lumbar plexus.
5th Lumbar pair.	{	<i>Anterior branch</i> .—Concurring in the formation of the sciatic plexus.

The posterior branches of the lumbar nerves are distributed to the loins, sacrum, and glutæal region.

Lumbar plexus.

{ 1st, *Musculo-cutaneous branches*, three in number; a *superior*, to the muscles of the abdomen, to the fold of the groin, and to the scrotum; a *middle*, to the integuments and muscles of the abdomen; an *inferior*, to the skin of the thigh; 2d, *Genito-crural branch*, to the integuments of the scrotum, groin, and thigh; 3d, *Crural nerve*, to the integuments, muscles of the thigh, to the skin of the leg and foot; 4th, *Obturator*, to the muscles of the internal part of the thigh; 5th, The anterior branch of the fifth lumbar gives off the *glutæal* for the muscles of that region.

SACRAL NERVES.

1st, 2d, 3d,  
and 4th  
Sacral  
pair.

{ *Anterior branches*.—These form by their union the sciatic plexus.

5th and 6th  
pair.

{ *Anterior branches*.—To the neighbouring parts of the os coccygis.

The posterior branches ramify in the muscles and integuments of the glutæal region.

Sciatic plexus.

{ 1st, *Hæmorrhoidal branches*, to the rectum; 2d, *Vesical*, to the bladder; 3d, *Uterine* and *voginal*, to the uterus and vagina; 4th, *Lesser sciatic*, to the glutæal and perinæal muscles, and to the integuments of the posterior part of the thigh; 5th, *Pudic*, to the perinæum, penis, or vulva; 6th, *Sciatic*, divided into the *external popliteal*, ramifying in the integuments and muscles of the external side of the leg, on the back of the foot, and dorsal surface of the toes; the *internal popliteal*, distributed to the dorsal surface of the last two toes, to the muscles of the foot, and plantar surfaces of all the toes.

I. CRANIAL NERVES.

They are twelve on each side, and arise from the brain, from the cerebral protuberance, and from the origin of the spinal marrow.

OLFACTORY NERVE.

[*Preparation*.—To see the lower roots of this nerve, we remove the membranes and arteries from the base of the scull, and sep-

arate the borders of the fissure of Sylvius. We see its superior root in the groove of the nerve by turning the latter backward.]

Soft, pulpy, prismatic, these nerves arise by three roots; one external and medullary, concealed in the fissure of Sylvius, and coming from the external region of the corpus striatum; another internal and medullary, shorter and broader than the preceding, confounded, posteriorly and on the inner side, with the white substance which occupies the internal part of the fissure of Sylvius; and a third, cortical, of a pyramidal form, placed at the point of junction of the two preceding, uniting to them by its summit. At the point of union of these branches, the nerve presents a triangular swelling, is directed horizontally forward and inward, lodged in the groove of the anterior lobe of the brain; gaining the cribriform plate of the ethmoid bone, it divides into a greater or less number of branches, which traverse the openings in this bone, and may be distinguished into, 1st, The *external branches*, ramifying on the turbinated bones of the nasal fossa, and anastomosing frequently together; 2d, The *internal*, twelve or fourteen in number, expanding into a great number of filaments on the septum narium, between the layers of the mucous membrane; 3d, The *middle*, which are distributed to the portion of this membrane which lines the roof of the nasal fossa.

#### OPTIC NERVE.

[*Preparation.*—We discover the roots of these nerves by opening the ventricles broadly at their lower part and by tracing these roots carefully to their origin; to see the course of the nerves to the eye, we must remove the floor of the orbit, detach the recti muscles of the eye, their aponeuroses of insertion, and the surrounding fatty cellular tissue. The globe of the eye is then opened from before backward.]

Very voluminous, soft, and pulpy at its origin, enveloped, after its union with that of the opposite side, by a white, thick neurilemma, which sends prolongations into the interior; it proceeds from the inferior part of the thalami optici, arising, in part, from the

tubercula quadrigemina by two bands, which are sent from each pair of these eminences to the optic chambers, and which unite to the corpora geniculata; directed forward and inward, it leaves the fissure placed between the middle lobes and pons varolii, and forms a communication with the tuber cinereum, which is placed immediately behind its junction with that of the opposite side; the two nerves join in front of the pituitary fossa, on the transverse groove of the sphenoid bone, beneath the anterior lobes of the brain; they afterward separate, are directed outward and forward towards the optic foramen, which they traverse, surrounded at this point by the posterior extremities of the four recti muscles of the eye. Having arrived at the postero-internal and inferior part of the globe of the eye, they pass across the sclerotic and choroid membranes, and terminate in the middle of the retina by a truncated extremity.

### THIRD PAIR.

[*Preparation.*—Remove the orbiter arch, draw the eye forward with a hook, and carefully separate the filaments of these nerves from the abundance of cellular tissue which surrounds them. We must be careful not to disturb the ophthalmic ganglion and branches which leave it.]

These arise from the internal part of the crura cerebri, between this and the mamillary protuberances, by soft filaments; they are directed forward and outward as far as the anterior point of the tentorium cerebelli; in this place they traverse a canal formed in the external wall of the cavernous sinus, and divide into two branches, which pass into the orbit by the broadest part of the sphenoidal fissure. *Superior branch.*—Directed forward and inward, passing above the optic nerve after getting between the two portions of the posterior extremity of the rectus external muscle; it is distributed to the inferior surface of the rectus superior, and gives a twig to the levator palpebræ superioris. *Inferior branch.*—More voluminous, placed beneath and on the outer side of the optic nerve; it divides into, 1st, An *internal twig*, which

ramifies in the rectus internus muscle ; 2d, A *middle*, lost in the rectus inferior ; and 3d, An *external*, which sends off a filament to the lenticular ganglion, and afterward penetrates, at nearly a right angle, into the inferior oblique muscle of the eye.

#### FOURTH PAIR.

[*Preparation*.—We remove the arch of the orbit, and open from behind forward the canal of the cavernous sinus, which contains this nerve.]

These are very delicate, and arise beneath the tubercula quadrigemina, from the lateral parts of the valve of Vieussens, by from one to four roots ; they are directed downward, outward, and forward, winding round the crura cerebri ; having arrived at the posterior clinoid processes, they enter a canal formed by the dura mater, separated from the cavernous sinus by a very thin cellular plate, and in relation with the other nerves of the eye ; they enter the orbit by the sphenoidal fissure, and are directed inward, ramifying in the superior oblique muscles of the eye.

#### FIFTH PAIR.

[*Preparation*.—To show the plexus formed by the trifacial nerve in the middle and lateral fossa of the base of the brain, we have only to remove the dura mater, under which it is placed.]

These arise from the superior extremity of the medulla oblongata, between the corpora olivaria and restiformia ; having arrived at the external inferior part of the crura cerebelli, they become free, and are composed of a number of filaments, varying from seventy to eighty or one hundred. The cord which they form is composed of two distinct fasciculi ; one anterior, consisting of five or six twigs ; the other posterior, is directed obliquely forward and outward, enters a canal of the dura mater, placed on the internal extremity of the superior border of the petrous portion of the temporal bone ; having arrived at the internal temporal fossa, it becomes flat, and forms a

grayish gangliform or plexiform swelling, from the anterior part of which proceed three branches; viz.: the *ophthalmic*, *superior maxillary*, and *inferior maxillary nerves*.

### 1. OPHTHALMIC NERVE.

[*Preparation*.—To see this nerve, we remove the arch of the orbit, and open the external wall of the cavernous sinus; we then trace the ophthalmic nerve into the muscles of the eye and eyelid. We then dissect the different twigs given off by it.]

This is directed forward, inward, and upward; and is situated in the external wall of the cavernous sinus, receiving a twig from the superior cervical ganglion, traversing the sphenoidal fissure, previous to which it becomes superior and internal to the third pair, which at first lay above it; it afterward divides into three branches, which pierce the dura mater separately, and are named the *lachrymal*, *frontal*, and *nasal nerves*.

1st, *Lachrymal branch*.—It is directed from behind forward and from within outward; enters the orbit placed along its external wall; gives off posteriorly the sphenomaxillary twig, which anastomoses with a twig from the superior maxillary nerve; anteriorly, the malar twig, anastomosing with a branch of the facial nerve, after having traversed the foramen in the malar bone. At the lachrymal gland it furnishes three or four twigs to its internal surface, and terminates in the superior eyelid by a great number of branches.

2d, *Frontal branch*.—It enters the orbit between the periosteum and posterior extremity of the superior rectus muscle, passes between the superior wall of the orbit and levator palpebræ superioris, and divides into two twigs. *Internal frontal twig*.—It is directed forward and inward, giving off a filament which anastomoses with one from the nasal nerve; afterward others which are lost in the superior eyelid, one of which goes to the frontal sinus; it then makes its exit from the orbit on the inner side of the superior

orbital foramen, and ramifies in the corrugator supercilii and frontalis muscles, and in the sub-cutaneous cellular tissue of the head, as far as its summit. *External frontal twig.*—It traverses the supra-orbital foramen, generally giving off, on the outer side, a filament to the upper eyelid, and on the inside a twig to the root of the nose; it is divided into two branches, which are reflected on the forehead behind the corrugator supercilii, and again subdivided into deep filaments for the corrugator and frontalis muscles and integuments, and into superficial filaments, which extend over the summit of the head towards the occiput, and anastomose with those of the opposite side, as also with those of the facial and first cervical nerves.

3d, *Nasal branch.*—It enters the orbit between the posterior attachments of the rectus externus muscle; is directed obliquely forward and inward; gains the internal wall of the orbit under the obliquus superior muscle; frequently receives, before entering this cavity, a filament from the superior cervical ganglion; on its entry, it furnishes a very delicate twig to the lenticular ganglion; also two or three ciliary filaments, which go on towards the eye; and at length it divides into two branches. *Internal nasal twig.*—This enters the anterior internal orbital foramen, gets into the cranium, and immediately passes into the nasal fossa by the small fissure situated at the anterior part of the ethmoidal grooves, on the sides of the crista galli process, and divides into two filaments, the one internal, the other external; the former divides on the anterior part of the septum narium into two other filaments, which go to the integuments of the lobes of the nose; the latter gives off a filament, which descends behind the bones of the nose, and terminates at the anterior part of the external wall of the nasal fossa. *External nasal twig.*—This comes out from the orbit beneath the pulley of the superior oblique muscle; anastomoses with a filament of the internal frontal branch, and divides into a number of filaments, which go to the eyelids, lachrymal



passages, and dorsum of the nose, in anastomosing with the internal frontal, infra-orbital, and facial branches.

## 2. SUPERIOR MAXILLARY NERVE.

[*Preparation.*—After removing the arch of the orbit, the eye and its appendages, we saw the zygomatic arch anteriorly and posteriorly; we remove the masseter and temporalis muscles, and the half of the lower jaw, preserving the buccinator muscles and the other muscles of the face; we also divide the pterygoidei muscles near their upper insertion. By this preparation the nerve can be preserved to its divisions. To prepare the anterior dental nerve, we open the anterior dental canal in its full extent. We see the posterior dental nerves by removing with care the surrounding cellular tissue and the branches of the internal maxillary artery, and by opening the bony canals in which these nerves are situated.]

It proceeds from the middle part of the ganglion of the fifth pair, already described; enters by the foramen rotundum of the sphenoid bone into the sphenomaxillary fossa, where it receives one or two twigs which proceed from the sphenopalatine ganglion; it passes through the infra-orbital canal, and terminates in the cheek. The branches which it furnishes are, 1st, *The orbital branch*, which passes into the orbit by the sphenomaxillary fissure, and there divides into two filaments; the one, the *malar*, anastomosing with the lachrymal nerve, traversing the malar bone, and ramifying in the orbicularis palpebrarum; the other, the *temporal*, passing across the orbital portion of the malar bone, uniting with a twig of the inferior maxillary, and, piercing the temporal aponeurosis, it is lost in the skin of the temples and summit of the head. 2d, *Posterior and superior dental branches.*—Three or four in number, separating from the superior maxillary in the sphenomaxillary fossa, entering the passages in the maxillary tuberosity, and dividing into many filaments, which gain the root of the last three or four molar teeth. One of them penetrates the maxillary sinus, and anastomoses with a twig from the anterior dental nerve; another is distributed to the gums and buccinator muscle. 3d, *Anterior den-*

*tal branch.*—It comes off from the superior maxillary nerve in the infra-orbital canal; descends into the anterior dental canal; furnishes a twig to the maxillary sinus, and divides into very many others, which terminate at the roots of the incisor teeth, of the canine, and of the two small molar teeth. 4th, *Infra-orbital branches.*—These form the termination of the superior maxillary nerve; they pass out by the infra-orbital foramen in a considerable number, anastomosing with the twigs from the facial, nasal, and buccal branches, and are divided into the superior branches, which ramify in the inferior eyelid, integuments of the cheek, caruncula lachrymalis, and lachrymal sac; and into inferior, which are distributed to the skin and muscles of the superior lip; into internal branches, which ramify on the back of the nose and alæ nasi, and in the muscles of this part; and lastly, into external branches, which spread in the zygomatic muscles, levator anguli oris, and skin.

### 3. INFERIOR MAXILLARY NERVE.

[*Preparation.*—We begin by removing the skin which covers the parotid gland, malar bone, and temporal fossa, avoiding the branches of the facial nerve. We then detach the temporal muscle from above downward, being careful not to divide the nerves which enter this muscle on its inner face. We separate by fragments the great wing of the sphenoid bone, and the squamous portion of the temporal bone to near the external auditory passage. The buccal nerve is prepared by sawing the lower jaw near its centre, and turning it backward. The dissection of the temporal nerve requires us to saw the condyle of the jaw, and to draw it outward with the pterygoideus externus muscle. The cord of the tympanum is prepared by removing carefully the upper and anterior part of the glenoid cavity. We show the lingual and inferior dental nerves by separating the fragments of the lower jaw which were previously sawed, and by drawing out the tongue with a hook.]

This nerve is larger than the preceding, and is composed at its origin of two portions, one of which is plexiform; it passes out of the cranium by the foramen ovale of the sphenoid bone, and divides in the zygomatic fossa into two trunks, the superior of

which gives origin to the *deep temporal*, *masseteric*, *buccal*, and *pterygoid* branches; the inferior furnishes the *lingual*, *inferior dental*, and *auricular* branches.

1st, *Deep temporal branches*.—Two in number, ascending, one in front, the other behind, between the temporal fossa and temporalis muscle; they divide into a great number of filaments, which are lost in this latter muscle, and anastomose with the facial and superior maxillary branches.

2d, *Masseteric branches*.—They are directed outward, downward, and backward; they traverse the sigmoid notch of the superior maxillary bone, between the temporal muscle and neck of the condyle of the inferior maxilla; they send some filaments to this latter articulation, and ramify in the middle of the masseter muscle.

3d, *Buccal branch*.—This is directed forward and downward, passing between the pterygoid muscles; it sends some twigs to the temporal muscle; passes between the coronoid process and the buccinator muscle, and divides on this muscle into six or seven twigs, which are given off to the temporalis, buccinator, and levator anguli oris, to the commissure of the lips and to the skin, anastomosing with one another, and with the facial and infra-orbital nerves.

4th, *Pterygoid branches*.—These are very delicate, two in number, directed downward, and terminate in the pterygoideus internus muscle.

5th, *Lingual branch*.—It communicates, near its origin, with the inferior dental nerve by a short twig, and receives the twig termed the *corda tympani*, which comes from the sphenopalatine ganglion; it then descends obliquely forward, between the internal pterygoid muscle and ramus of the inferior maxilla, passes between the sub-maxillary gland and mucous membrane of the mouth, between the mylo-hyoideus and hyo-glossus muscles, and arrives at the inferior lateral part of the tongue. It furnishes in its passage a twig to the pterygoideus internus muscle, two or three to the tonsils and constrictor pharyngis superior, two or three others to the postero-internal part of the gums;

beyond the submaxillary gland it gives many twigs, which anastomose with those of the ninth pair; four or five which go to the sublingual gland, and nearly as many to the anterior part of the gums and mucous membrane of the mouth; lastly, it divides into a great number of twigs, which penetrate the tissue of the tongue, and ascend towards the superior surface, to be distributed to the mucous membrane of that organ.

6th, *Inferior dental nerve*.—It receives a twig from the preceding; descends at first between the two pterygoidei muscles, afterward between the pterygoideus internus and inferior maxilla; gives off a branch, which is lodged in a groove in this bone, and divides near the chin into four or five twigs, which are distributed to the mylo-hyoideus, genio-hyoideus, and digastricus; it afterward enters the dental canal, furnishes twigs to the roots of the five molar teeth, and divides into two branches; the internal, distributed to the roots of the canine and incisor teeth; the external, passing out by the mental foramen, and dividing into a number of radiating twigs, which are distributed to the muscles of the inferior lip and chin, is anastomoses with the branches of the facial nerve.

7th, *Auricular branch*.—It turns backward and outward, between the condyle of the inferior maxilla and auditory canal; anastomoses by two twigs with the facial nerve; gives off a twig to the temporo-maxillary articulation, some other twigs to the pavilion and skin of the ear, and divides into two branches, an anterior and a posterior, which ramify in the integuments of the temples, forehead, and summit of the head, and anastomoses with the facial nerve.

#### SIXTH PAIR.

[The preparation for this is the same as for the ophthalmic nerve.]

They rise by several filaments from the sides of the corpora pyramidalia, along which they proceed as far as the groove which separates the pons varolii

from the medulla oblongata ; here the filaments composing them unite and proceed forward and outward along the basilar groove, piercing the dura mater on the sides of the quadrilateral plate of the sphenoid bone ; they traverse the cavernous sinus, where they receive, on a level with the carotid artery, one or two filaments, which proceed from the superior cervical ganglion ; they ramify entirely in the rectus externus muscle of the eye.

#### FACIAL NERVE, OR PORTIO DURA OF THE SEVENTH PAIR.

[*Preparation.*—We saw the mastoid process at its base, and turn it downward and outward, as also the sterno-mastoideus muscle. We then dissect the parotid gland, from before backward and from within outward, to the trunk of the nerve, after which we follow its branches and twigs.]

The origin of this nerve becomes apparent behind the posterior border of the pons varolii, in the angle of its union with the corpus restiforme, a few lines on the outer side of the preceding, and about a line in front of the acoustic nerve ; it is then directed forward, outward, and upward, enters the internal auditory foramen with the acoustic nerve, leaves this latter to pass into the aqueduct of Fallopius, and comes out of the cranium by the stylo-mastoid foramen. On a level with the hiatus Fallopii it receives the superior twig of the vidian nerve, which, lying in apposition, but not anastomosing with it, enters the cavity of the tympanum under the name of the corda tympani. On a level with the tympanum, the facial nerve sends a twig to the tensor tympani, and another to the muscle of the stapes. On its exit from the stylo-mastoid foramen, it furnishes the *posterior auricular*, *stylo-hyoid*, and *sub-mastoid branches* ; the first is reflected and goes behind the pavilion of the ear, and there divides into an anterior twig, which ramifies on the inner face of the pavilion, and a posterior, which goes to the mastoid process and integuments. The stylo-hyoid twig gives several filaments to the muscles proceeding from the styloid process, and anastomoses by one or two others with the filaments from

the superior cervical ganglion; the third gives filaments to the posterior belly of the digastricus, and anastomoses by two branches with the glosso-pharyngeal and superior laryngeal nerves. The facial nerve then enters the parotid gland, and soon divides into two branches, one of which, the temporo-facial branch, sends off numerous twigs, which supply the temporal, malar, and buccal regions of the face, and also the superior and inferior lips; the other, the cervico-facial branch, descends and supplies the inferior regions of the face and upper part of the neck. The distribution of these branches of the facial nerve has been termed the *pes anserinus*.

#### THE AUDITORY NERVE, OR PORTIO MOLLIS OF THE SEVENTH PAIR.

[*Preparation.*—The filaments of these nerves may be traced to their origin by making in the cerebellum, or valvule of Vieussens, an incision from before backward, and by separating the edges of this division. These nerves are seen in the labyrinth by removing the compact substance which covers the petrous process, and by opening the internal auditory passage upward and backward.]

This nerve arises transversely, on the corpus restiforme, from a small band of gray substance which generally covers the base of this nerve, and which unites it to the floor of the fourth ventricle; generally some of its roots traverse this cord, and are continuous with the two superior white striæ observed on the sides of the calamus scriptorius; it becomes isolated from the substance of the brain, near a small triangular excavation placed between the corpus olivare, crus cerebelli, pons varolii, and corpus restiforme; it is then directed outward, forward, and upward, together with the facial nerve, which lies in a groove on its inner surface; it enters with this latter into the internal auditory canal, at the bottom of which it divides into two branches. The first, for the cochlea, divides at the base of this organ into a great number of delicate twigs, which enter the openings at its base, and ramify on the spiral plate, one of which enters the infundibulum by the canal of its axis; the second,

for the vestibulum and semicircular canals, divides into three branches; one for the vestibulum, which expands there in the form of a membrane, and sends off a twig for the semicircular canals, and is lost in the pulp which fills these cavities; a second, for the membrane of the vestibulum; and a third, for the posterior semicircular canal, expanding in the pulpy substance situated at its orifice.

#### GLOSSO-PHARYNGEAL NERVE.

[*Preparation.*—The upper part of these nerves, and also that of the hypo-glossal, pneumogastric, and spinal nerves, are seen as follows: first, we prepare the upper insertions of the sterno-mastoid, digastricus, and stylo-hyoid muscles; we saw the mastoid process, and separate it from the posterior belly of the digastricus muscle: it is then turned downward and outward: we also cut the styloid process, which is turned downward and forward with the muscles attached to it.]

This arises from the superior and lateral parts of the medulla oblongata, between the facial and pneumogastric nerves, but nearer these latter, in the groove which separates the corpora olivaria from the corpora restiformia; its filaments, united in a single cord, which is directed outward, traverses the anterior part of the foramen lacerum posterius, is directed downward and forward, is separated from the pneumogastric by the trunk of the internal jugular vein, passes on the internal carotid artery, and beneath the stylo-pharyngeus muscle, afterward between it and the stylo-glossus, and descends obliquely forward to the postero-inferior part of the tongue. After its exit from the cranium, it sends a twig to the auditory canal, receives a filament from the facial, and another from the pneumogastric nerve; it afterward furnishes two other twigs, which descend on the carotid artery, and unite, in the inferior part of the neck, to branches of the cervical ganglia. It also gives off two pharyngeal branches, directed downward, inward, and backward, which are distributed to the superior and middle constrictors of the pharynx, to the mucous membrane of the same, to



the amygdalæ, to the stylo-pharyngeus muscle, to the posterior part of the tongue, and at length terminate in the pharyngeal plexus. Beneath the stylo glossus and hyo glossus muscles, the glosso-pharyngeal nerve divides into superior, inferior, and middle branches; the superior for the lingualis muscle and constrictor isthmi faucium, mucous glands, and amygdalæ; the inferior for the hyo-glossus and mucous membrane of the epiglottis; and the middle enter the fibres of the tongue, and are lost in the mucous follicles.

#### PAR VAGUM, OR EIGHTH PAIR.

[*Preparation.*—The preparation of these nerves on leaving the cranium and in the neck, is the same as that of the glosso-pharyngeal. To follow them in the chest, we must remove the anterior part of the thorax, including the sternum and the anterior half of the clavicles and ribs. The posterior pulmonary plexus is perceived by turning the lung from behind forward, and by detaching the pleura which covers it, and that which forms the posterior mediastinum. To see these nerves in the abdomen, we open the abdominal cavity, draw the liver upward and to the right, and carefully dissect the gastro-splenic and gastro-hepatic epiploa, after dividing the diaphragm; in this manner we shall easily see the different twigs of the pneumogastric nerve.]

This arises immediately beneath the preceding, behind the corpora olivaria, near the corpora restiformia, by numerous filaments; it is directed outward and forward, passes out of the cranium by the foramen lacerum posterius, and is united below this foramen with the hypo-glossal and glosso-pharyngeal nerve, from which it soon separates. It afterward descends with the great sympathetic on the anterior and lateral parts of the neck, on the recti muscles and longus colli, on the outer side of the primitive carotid, and posterior to the internal jugular vein; it passes into the chest behind the subclavian vein, getting posterior to the bronchial tubes, and arrives at the stomach with the œsophagus, which it accompanies. In the interior of the foramen lacerum posterius, or beneath it, the eighth pair anastomoses by small twigs with the spinal, glosso-pharyngeal, and ninth pair, and with the branches of the superior cervical ganglion; it furnishes in its course,



1st, *The pharyngeal branch*.—Coming off from the par vagum near the cranium, it passes downward and forward, and after receiving a twig from the spinal nerve, it crosses the internal carotid, behind which it is situated, and to which it gives filaments; arriving at the pharynx, it divides into a number of filaments, which anastomose with the glosso-pharyngeal, superior laryngeal, and superior cervical ganglion, forming thus the pharyngeal plexus, which sends nerves to the adjacent parts.

2d, *Superior laryngeal branch*.—It separates from the trunk under the preceding, and is directed downward and forward, gliding under the internal carotid, and dividing into two branches, the *external* and *internal laryngeal*; the former ramifies on the sides of the larynx, in the sterno-hyoid, thyro-hyoid, inferior constrictor, and crico-thyroid muscles; the latter traverses the thyro-hyoid membrane, and is distributed to the anterior surface of the epiglottis, mucous membrane of the pharynx and larynx, arytenoid gland and muscle.

3d, *Cardiac branches*.—On the right side, near the origin of the corresponding carotid, the par vagum gives off two, and sometimes three twigs, which descend with it, and anastomose with the cardiac filaments of the inferior cervical ganglion; on the left side it furnishes usually but one twig, which is in apposition with the arch of the aorta, and is lost in the neighbouring cardiac plexus.

4th, *Inferior laryngeal, or recurrent branch*.—It arises in the chest, and differs on the right and left side; the left arises lower down than the right, and winds round the arch of the aorta; the right passes round the subclavian artery, and mounts on the lateral parts of the trachea as far as the larynx, where it terminates. In this course the recurrent gives off two or three cardiac twigs, a few filaments which follow the pulmonary artery, and a few which supply the œsophagus, thyroid gland, and mucous membrane of the trachea. At the inferior part of the larynx it gives a few filaments to the inferior con-

strictor, and divides into twigs for the mucous membrane of the pharynx, and crico-arytenoid and thyro-arytenoid muscles.

After furnishing the recurrent, the par vagum gives off three or four twigs, which descend on the anterior face of the trachea, unite to the filaments of the inferior laryngeal and inferior cervical ganglion, and thus concur to form the pulmonary plexus; also three or four twigs, which pass behind the trachea, and supply its mucous membrane and the œsophagus. Before arriving at the bronchus, its filaments separate and form the pulmonary plexus with the branches previously described, and with the inferior cervical ganglia; this plexus, occupying the posterior part of each lung, sends off numerous filaments, which follow the distribution of the bronchial tubes. Beneath this plexus, the filaments of the par vagum unite again and form the two œsophageal cords, which frequently anastomose; that of the right side descends on the lateral posterior parts of the œsophagus, that of the left side on the anterior part of the same organ; the former divides in the abdomen into a great number of filaments, which spread on the posterior surface of the stomach, penetrating its walls, and joining the hepatic, cœliac, and splenic plexuses; the latter follows the little curve of the stomach as far as the pylorus, and sends twigs into the interior of this organ.

#### NERVUS ACCESSORIUS OF WILLIS.

[*Preparation.*—First raise the brain from the cavity of the skull, and cut the lower and back part of the occipital bone and the laminae of the cervical vertebræ. We then divide the dura mater, and turn it over from the tentorium of the cerebellum to the base of the cervical region, and the cerebellum, from before backward, to the fourth ventricle, and separate the two portions; we then cut the posterior roots of the cervical nerves. We can now follow the spinal nerve along the medulla to the brain. To see it leave the skull, we make the same section as for the glosso-pharyngeal nerve, and separate the internal jugular vein, which covers it.]

This arises from the lateral parts of the spinal marrow, in the interior of the vertebral canal; generally

the first point of origin is above the posterior root of the fourth cervical nerve, by a small point situated between two cervical nerves, or between two divisions of the same nerve; sometimes it is seen lower, that is, opposite the sixth or seventh vertebra of the same region; it mounts then between the ligamentum denticulatum and posterior roots of the cervical nerves, receiving at the origin of these latter new filaments, which increase it in size; it passes into the cranium by the occipital foramen, is directed upward, outward, and forward, traverses the foramen lacerum posterius beneath the par vagum, to which it sends a twig; it then separates from the par vagum, and adheres to the ninth pair, which it again leaves in passing behind the internal jugular vein to reach the sterno-mastoid muscle, which it traverses, and terminates in the trapezius. It sends a small twig in the canal of the dura mater to the par vagum, which unites with the pharyngeal branch of this latter nerve, and then divides into several filaments, which blend with those composing the par vagum, and in traversing the mastoid muscle it communicates by two or three branches with those of the cervical plexus. It terminates by numerous filaments in the trapezius muscle.

#### NINTH PAIR.

[*Preparation.*—The same as for the glosso-pharyngeal nerve.]

It arises, by ten or twelve very delicate filaments (in front of which the vertebral artery passes), from the grooves which separate the olivary from the pyramidal eminences; these soon unite into one cord, which passes out of the cranium by the anterior condyloid foramen; here this cord gives off one or two twigs, which communicate with the plexus formed by the first two cervical nerves, directed downward and forward, and curving beneath the tendon of the digastricus, it passes forward towards the tongue, after having formed a curve, from the convexity of which comes off the *descendens noni*, which passes in front of the internal jugular vein; curving backward, it an-

astomoses, towards the middle of the neck, with the internal descending branch of the cervical plexus. The ninth pair then passes between the mylo-hyoideus and hyo-glossus; it furnishes branches to the superior constrictor of the pharynx, the stylo-pharyngeus, the external surface of the hyo-glossus, the genio-hyoideus, the anterior part of the genio-glossus and mylo-hyoideus; it afterward passes on the sides of the genio-glossus, and sends twigs to this muscle, from the base of the tongue as far as its point.

#### VERTEBRAL NERVES IN GENERAL.

[*Preparation.*—Open the vertebral canal, after removing the muscles from the vertebral grooves, and divide from above downward the membranes which envelop the spinal marrow.]

Thirty-one on each side, arising from the sides of the spinal marrow; termed numerically, the first, the second pair, &c., and divided, according to the region which they occupy, into cervical, dorsal, lumbar, and sacral. They arise by two roots, an anterior and a posterior; these roots are formed each by a greater or less number of filaments, and unite in passing through the holes of conjugation; the posterior only form a peculiar species of grayish ganglion. At their exit from the holes of conjugation, the trunk of each nerve divides into two branches, the one anterior, the other posterior.

#### CERVICAL NERVES.

These are eight in number; the first passes between the occiput and atlas, the last between the seventh cervical and first dorsal vertebra. Their anterior roots arise by two fasciculi, formed of seven or eight filaments, which unite. The posterior roots are larger, and arise in a fissure of the spinal marrow, by a more considerable set of fasciculi, but varying in their number.

*First cervical pair.*—The *sub-occipital* of some anatomists. It arises from the sides of the spinal marrow, beneath its superior enlargement, and passes out from

the vertebral canal between the occiput and atlas, by the fibrous passage which conducts the vertebral artery. *Anterior branch*.—Long and narrow, directed from behind forward, passing above the transverse process of the atlas, descending in front of it, and anastomosing with a filament of the second pair, so as to form a species of circle, which embraces this process; it furnishes branches to the rectus lateralis, rectus anticus minor, to the superior cervical ganglion, par vagum, and ninth pair of nerves. *Posterior branch*.—It is directed backward and upward, and divides into the internal and external occipital twigs, and inferior cervical; the first supplies the great complexus and recti postici muscles; the second the obliquus capitis superior; the third descends to the obliquus capitis inferior, and anastomoses with the posterior branch of the second cervical pair.

*Second cervical pair*.—The first of some anatomists. *Anterior branch*.—It winds between the transverse processes of the first two vertebræ, and divides into many branches; one anastomoses with a filament of the first pair; another joins the superior cervical ganglion; a third goes to the rectus anticus capitis; a fourth concurs to form the cervical plexus; and a fifth, very small, communicates with the par vagum. *Posterior branch*.—It is reflected from below upward, under the inferior border of the obliquus capitis inferior, passes inward in traversing the great complexus, becomes sub-cutaneous, and divides into a number of branches. At its origin it anastomoses with the first and third pair, and gives a filament to the levator anguli scapulæ; at its reflection it sends filaments to the great and little complexi muscles, to the splenius, and sometimes to the trapezius and sternomastoideus; posteriorly its branches are distributed to the integuments and occipito-frontalis muscle, and communicate with the filaments of the frontal, sub-occipital, and posterior auricular nerves, and with those of the cervical plexus.

The anterior and posterior branches of the *third* and *fourth cervical pair* proceed in similar directions;

the anterior pair sending off branches to form the cervical plexus, while the posterior supply the integuments and muscles of the back part of the neck.

#### CERVICAL PLEXUS.

[*Preparation.*—We discover the superficial branches by carefully cutting the skin from the occipital bone to the clavicle, along the posterior edge of the sterno-mastoid muscle. We then carefully dissect the skin and platysma muscle, and follow the branches and superficial twigs of the plexus; to see the deep branches, we cut the sterno-mastoid muscle crosswise, turn back the two portions, and follow the twigs of the plexus and their anastomoses. The diaphragmatic nerve is prepared like the pneumogastric.]

This is formed by the anterior branches of the second, third, and fourth cervical nerves, which anastomose and form arches, the convexities of which send off twigs, which unite again. *Situation.*—On the lateral parts of the neck, on a level with the second, third, and fourth vertebræ. *Relations.*—On the inner side with the scalenus posticus, par vagum, carotid artery, and jugular vein; on the outer side with the posterior border of the sterno-mastoid muscle. *Divisions.*—Communicating superiorly with the first pair; inferiorly with the brachial plexus; furnishing one or two filaments to the spinal nerve, and many branches, divided into the descending and ascending; on the inside, with the ganglionic system.

1st, *Internal descending branch.*—Formed by two twigs coming from the second and third pair, and forming a cord, which descends on the sterno-mastoid muscle, and anastomoses, in the middle of the neck, with a twig from the ninth pair of nerves.

2d, *Phrenic nerve.*—Principally composed of a branch which comes from the fourth pair; receiving frequently a twig from the third, and two or three from the brachial plexus; it descends along the anterior part of the neck, between the anterior rectus and anterior scalenus; communicating with the inferior cervical ganglion by one or two filaments; passing into the chest between the subclavian artery posteri-

only, and subclavian vein anteriorly; it enters the anterior mediastinum, then descends as far as the diaphragm, between the pleura and lateral parts of the pericardium. The right phrenic nerve divides into six or seven filaments; some ramify on the superior surface of the diaphragm, others on its inferior surface, or accompany the diaphragmatic arteries and veins. That of the left side turns round the point of the heart, and consequently is longer than the right, and more posterior: it is distributed to the upper and lower faces of the diaphragm, and gives filaments to the œsophagus, and anastomoses with the solar and cœliac plexus.

3d, *External descending branches*.—These are four or five in number, and are divided into the supra-clavicular, sub-acromial, infra-clavicular, and deep cervical branches, which are distributed to the mastoid, auricular, and scapular regions, and send off numerous twigs, which supply the integuments and muscles of these regions.

4th, *The mastoid branch*.—It ascends along the posterior edge of the sterno-mastoid muscle to the mastoid process, where it divides into filaments, which are distributed to the skin of the side of the head, to the inner face of the pavilion of the ear, to the occipito-frontalis muscle, and anastomose with the facial nerve and the posterior branch of the third pair.

5th, *The auricular branch*.—It is larger than the preceding, and goes upward and outward, is reflected on the posterior edge of the sterno-mastoid muscle, ascends on its external face to the angle of the jaw, where it gives off anterior and posterior branches, which are distributed to the parts around.

6th, *The superficial ascending branches*.—These are two in number; sometimes there exists but one, coming principally from the third pair; they are distributed to the sterno-mastoid muscle, platysma myoides, skin of the neck, and inferior maxillary region, and anastomose with twigs from the facial nerve,



## FIFTH, SIXTH, SEVENTH, AND EIGHTH CERVICAL PAIRS.

*Anterior branches.*—These are very large, and are situated between the *scleni* muscles, in front of the posterior: they each anastomose, by one or two small filaments, with the cervical ganglions, and communicate to form the brachial plexus. The *posterior* branches are smaller than these, descend obliquely on the outside between the *inter-transversarii* and *complexus major*, to which they give filaments, and ramify in the *splenius* and *trapezius*, and in the integuments of the posterior part of the neck and the back.

## BRACHIAL PLEXUS.

[*Preparation.*—First cut the external insertion of the *pectoralis major* and *minor* muscles: turn them over, without disturbing the recurrent nerves of the second and third dorsal pairs; then raise the clavicle, and dissect the *subclavius* muscle. This preparation shows the brachial plexus, the different branches of which may be dissected and rendered more apparent.]

This is formed by the interlacing of the anterior branches of the last four cervical pair and first dorsal nerves. *Form.*—Broad superiorly and inferiorly, contracted in the middle. *Extent.*—From the infero-lateral part of the neck as far as the axilla. *Relations.*—At its origin, with the *scleni* muscles, between which it lies; afterward with the *subclavius* muscle and first rib, the superior portion of the *ser-ratus magnus*, axillary artery and vein. *Divisions.*—The branches which it furnishes are the *thoracic*, *supra* and *infra-scapular*, *internal* and *external cutaneous*, *median*, *radial*, *ulnar*, and *circumflex*.

1st, *Anterior thoracic branch.*—Principally furnished by the seventh cervical pair; it descends behind the clavicle, and divides into numerous filaments, some of which surround the axillary artery; others descend on the chest, and are distributed to the pectoral muscles. 2d, *Posterior thoracic branch.*—Coming from the fifth and sixth cervical pairs, descending on the



sides of the chest, applied against the serratus magnus, in the inferior third of which it ramifies entirely.

*Supra-scapular branch.*—This arises from the fifth pair, descends obliquely backward towards the superior border of the scapula, passing under the ligament which converts the notch in the superior border of the scapula into a foramen; after having given a branch to the sub-scapularis muscle, it sends several filaments to the supra-spinatus, and passes into the infra-spinatus fossa, where its ramifications are lost in the infra-spinatus and teres minor muscles.

*Sub-scapular branches.*—Two or three generally in number, which vary at their origin; the first passes behind the axillary vessels, descends between the serratus magnus and sub-scapularis muscles, and ramifies on the anterior surface of the latissimus dorsi; the second is distributed to the internal surface of the sub-scapularis muscle; the third descends obliquely along the sub-scapularis, and ramifies in its thickness, and in the teres major and minor muscles.

*Internal cutaneous nerve.*—Smaller than the following branches of the brachial plexus, formed nearly entirely by the first dorsal and last cervical nerve; it descends vertically along the internal surface of the arm, under the brachial aponeurosis, near the basilic vein, and divides, near the internal condyle of the humerus, into two branches. The *external branch* is applied along the border of the biceps, pierces the aponeurosis, passes downward and forward from the middle of the fold of the arm towards the wrist, where it ramifies in the integuments. On the fore-arm it gives off radial and ulnar twigs, which anastomose with the internal branch of the same nerve, and with the external cutaneous branch. The *internal branch* descends on the brachialis internus, and divides, near the epitrochlea, into an anterior twig, which ramifies in the integuments of the fore-arm, and sends some filaments to its posterior surface; and a posterior twig, which descends on the dorsal surface of the fore-arm, along the ulna, and is distributed to the integuments of the back of the hand and little finger.

*External cutaneous nerve.*—Coming principally from the fifth and sixth cervical nerves ; it descends obliquely outward behind the coraco-brachialis muscle ; it passes through its fibres, and descends along the anterior part of the arm, between the biceps and brachialis internus ; it traverses the fold of the arm, and descends along the anterior external part of the fore-arm, between the aponeurosis and skin ; near the wrist it divides into two branches ; an *external*, which sends a twig to the dorsal surface of the fingers, and terminates on the external side of the thumb, sending some twigs to the indicator ; and an *internal*, distributed to the muscles of the thumb, palm of the hand, and to the fingers.

*Median nerve.*—The largest of the nerves of the brachial plexus, formed principally by the first dorsal and seventh and eighth cervical pair, to which is united a cord from the fifth and sixth cervical ; it descends a little outward, behind the internal part of the biceps, on the inner side of the brachial artery, traversing the middle of the fold of the arm, dipping between the brachialis internus and pronator teres, and descends along the fore-arm between the superficial and deep-seated flexor muscles. It then traverses, with the tendons of these muscles, the opening of the annular ligament of the carpus, and divides in the hand into digital branches, which proceed to the fingers. Before this division, it furnishes branches to the pronator teres, palmaris longus, radialis internus, and ulnaris internus, flexor digitorum, flexor proprius pollicis manus, and sends off an interosseal branch. This latter sends a twig to the superficial flexor, then descends on the anterior surface of the interosseous ligament, sends lateral twigs to the flexor profundus and flexor proprius pollicis, passes under the pronator quadratus, traverses the inferior opening of the interosseous ligament to spread on the dorsum of the hand ; it then divides into five digital branches, which accompany the collateral arteries of the fingers, and spread their filaments in the cellular tissue and skin.

*Ulnar nerve.*—Principally furnished by the eighth

cervical and first dorsal ; it descends along the inner part of the arm on the internal border of the triceps. Near the elbow it supplies this muscle, and the integuments of the upper part of the fore-arm, with a few filaments, and passes between the internal condyle of the humerus and the olecranon ; gives many branches to the ulnaris internus, descends along the anterior internal part of the fore-arm, and divides near the wrist into two branches, the *palmar* and *dorsal* ; the former passes along the external border of the tendon of the ulnaris internus, on the side of the os pisiforme, and divides near the hand into the deep, the superficial, the external and internal branches, which supply the integuments and fingers, and anastomose with the branches of the median nerve ; the latter, or dorsal, turns backward, and gains the internal part of the back of the hand, and divides into internal and external branches, which ramify on the corresponding surfaces, supplying the middle, the ring finger, and the little finger.

*Radial nerve.*—This proceeds principally from the sixth and seventh cervical pair, and from the first dorsal ; descends posteriorly between the three portions of the triceps muscle, winds round the humerus from above downward and from within outward to gain the external side of the arm, and divides into two branches on the articulation of the elbow, after having furnished a considerable branch of the integuments of the postero-external part of the fore-arm, where it ramifies as far as the thumb. Its anterior branch descends between the two supinators, along the anterior external part of the fore-arm, and divides towards its inferior third into two branches, an external and an internal ; the former for the thumb and indicator, for the internal and dorsal side of the same, and external side of the medius finger. Its posterior branch gives off twigs to the muscles of the fore-arm, passes across the supinator radii brevis to gain the posterior surface of the fore-arm, where it divides into posterior and anterior twigs, which are distributed to the superficial muscles of these regions.

*Circumflex nerve.*—Formed most frequently by the last two cervical pair and first dorsal; it descends in front of the sub-scapularis muscle, to which it sends a twig, winds from before backward and from within outward, between the superior part of the humerus and long portion of the triceps, to gain the posterior border and internal surface of the deltoid muscle; on a level with the triceps, it divides into two branches, the one superior, the other inferior, which are lost entirely in the deltoid muscle.

## 2. DORSAL NERVES.

[*Preparation.*—We make in the thorax the same incision as for the pneumogastric nerve, and remove the lungs and pleura: we divide the internal intercostal muscles, and trace the anterior branches of these nerves. To see them on the thorax, we have merely to dissect the integuments which cover it: we open the abdomen to follow the anterior branch of the twelfth dorsal pair, which is found under the diaphragm. The posterior branches of these nerves are prepared by cutting the skin, the trapezius, the latissimus dorsi, the rhomboideus, which is turned outward, and by dissecting the muscles from the grooves of the vertebræ.]

These consist of twelve pair; the first passes out between the first two dorsal vertebræ, and the last between the last dorsal and first lumbar. They divide into anterior and posterior branches. The *posterior* pass backward between the transverse processes of the dorsal vertebræ, and distribute their twigs to the integuments and muscles of the back and loins. The *anterior* receive near their origin a twig from each thoracic ganglion, pass outward between the ribs, covered by the pleura, as far as the angle of these bones, where they get between the two planes of intercostal muscles. The anterior branch of the first dorsal follows the external border of the first rib, and unites to the last cervical pair to form the brachial plexus. The anterior branch of the second follows the internal surface of the second rib, and sends off a brachial twig, which pierces the external intercostal muscle, and descends along the postero-internal part of the arm, and is lost at the elbow; this is named the nerve of Wrisberg. The anterior branches of the

fourth, fifth, sixth, seventh, eighth, ninth, tenth, and eleventh pair proceed along the inferior border of the corresponding ribs, and are distributed to the integuments and muscles of their different regions. The anterior branch of the twelfth dorsal, at its origin, communicates by a twig with the first lumbar nerve, and is afterward distributed to the integuments and muscles of the abdomen.

### 3. LUMBAR NERVES.

[*Preparation.*—For these, as well as for the lumbar plexus, we open the abdomen by a crucial incision, turning the bundle of intestines from the side opposite to that prepared, and detach the peritoneum and the cellular tissue which cover the lumbar muscles, and turn over the psoas muscles after dividing them; we then find the lumbar nerves near their origin, and then they can be easily traced.]

These consist of five pair, arising very near one another from roots formed of two broad fasciculi, which compose a species of cord termed the cauda equinæ. These nerves present anterior and posterior branches. The posterior go backward between the transverse processes of the corresponding lumbar vertebræ, and send twigs to the sacro-spinalis muscle. The anterior receive a filament from the lumbar ganglions, anastomose with those of the other lumbar nerves, and contribute to form the lumbar plexus.

The anterior branches of the five lumbar nerves form by their union the *lumbar plexus*, which is situated on the lateral parts of the body of the second, third, and fourth lumbar vertebræ, behind the psoas muscle. *Form.*—Narrow superiorly, broad inferiorly.

*Divisions.*—It furnishes the *musculo-cutaneous*, *genito-crural*, *crural*, *obturator*, and *lumbo-sacral* branches.

*Musculo-cutaneous branches.*—Generally three in number; 1st, The superior, proceeds from the first lumbar pair, descends on the quadratus lumborum as far as the crest of the ilium, pierces the transversalis muscle, and ramifies by one of its twigs in the muscles and integuments of the abdomen; the other twig follows the crural arch as far as the inguinal ring, and is distributed to the groin, pubic region, scrotum in

the male, and labia in the female; 2d, The middle branch descends on the external border of the psoas muscle, pierces the transversalis near the crest of the ilium, supplies the integuments there, and sends a twig to the superior external part of the scrotum; 3d, The inferior branch arises from the second pair, follows the external border of the psoas, passes out of the pelvis between the superior and inferior spinous processes of the ilium, and ramifies on the postero-superior part of the thigh; an internal twig pierces the aponeurosis of the fascia lata, and descends on the external part as far as the knee.

*Genito-crural branch.*—This proceeds from the first lumbar pair, descends at first in the thickness of the psoas muscle, afterward on its anterior surface; divides into an internal branch, which follows the spermatic cord; and an external, which in the groin sends off numerous twigs, which become sub-cutaneous, and extend to the centre of the thigh.

*Crural nerve.*—This arises from the first four lumbar nerves; descends on the iliacus muscle along the external border of the psoas, and passes out of the abdomen by the crural arch, on the outer and upper side of the femoral artery; it then divides into superficial and deep-seated branches. 1st, The superficial vary in number from two to six, pierce the fascia lata, and divide into a number of twigs, which are lost in the integuments of the anterior and inner part of the thigh, several of them descending as far as the superior part of the leg. 2d, The deep-seated are divided into the external, which are large and numerous, and descend between the iliacus, sartorius, and rectus femoris, and again divide into numerous twigs, which are distributed to these muscles; the internal are distributed to the inner part of the triceps adductor, pectineus, and sartorius muscles; one of these twigs accompanies the femoral artery as far as the knee; another, more considerable, termed the *internal saphena nerve*, descends along the internal part of the thigh and leg, accompanies the internal saphena vein in all its divisions, and terminates in the first toe

*Obturator nerve.*—It comes principally from the second and third pair, and sometimes from the fourth; it descends on the inner side of the internal border of the psoas muscle, follows the superior lateral part of the cavity of the pelvis, sends a twig to the obturator muscles, traverses the obturator foramen, and divides into two branches between the pectineus and first adductor. 1st, Its anterior twig supplies the little adductor and vastus internus, in which it entirely ramifies. 2d, Its posterior twig is lost in the great adductor and obturator externus muscles.

*Lumbo-sacral nerve.*—Formed by the anterior branch of the fifth lumbar and a branch of the fourth; it descends into the pelvis, and unites with the sciatic plexus, after having furnished the glutæal nerve, which comes out by the sciatic notch, and ramifies in the glutæus medius and minimus muscles.

#### SACRAL NERVES.

[*Preparation.*—We saw the pelvis anteriorly, and the sacro-iliac articulation posteriorly; we remove this portion; we then turn back the bladder and rectum, and find the nerves, after detaching the peritoneum and the surrounding cellular tissue.]

These consist of six pair, sometimes of five; they emerge from the sacral foramina, and arise from the inferior part of the spinal marrow. Their posterior branches anastomose with each other, and supply the various muscles in their neighbourhood; while the anterior branches of the first four sacral, with those of the fifth lumbar pair, form the *sacral plexus*. These branches, uniting again, form a large nerve, termed the *sciatic nerve*. The sacral plexus is seen at the postero-lateral part of the pelvis, on the pyramidalis muscle, behind the hypogastric vessels, rectum, bladder, and uterus in the female, and much adipose tissue. *Divisions.*—It furnishes the *hæmorrhoidal*, *vesical*, *uterine*, and *vaginal*, which are small, and interlace with one another; and the inferior *glutæal*, *pudic*, and *sciatic*.

*Hæmorrhoidal twigs.*—These are small: they penetrate the posterior wall of the rectum; the ascending



twigs mount up towards the colon ; the descending go to the sphincter muscle of the anus.

*Vesical, vaginal, and uterine.*—Are distributed to the bladder, vagina, and uterus.

#### INFERIOR GLUTÆAL NERVE.

Coming from the second and third sacral pair ; it passes out of the pelvis by the sciatic notch, beneath the pyramidalis muscle, and divides into a great number of twigs, which supply the superior part of the anterior surface of the glutæus maximus, its internal and inferior part, the integuments of the supero-internal part of the thigh, perinæum, and penis ; also a branch, which, becoming sub-cutaneous, descends behind the thigh, and is lost in the integuments of the leg.

#### PUDIC NERVE.

Arising principally from the third and fourth sacral pair ; it passes out of the pelvis beneath the pyramidalis muscle, between the two sacro-sciatic ligaments, and divides into two branches ; the inferior branch, in man, mounts along the internal part of the tuberosity of the ischium, is directed forward along the perinæum, and is lost in the scrotum ; the superior branch, in man, mounts along the ramus of the ischium and of the pubis, as far as the symphysis, passes on the superior surface of the penis as far as the glans, where it terminates. In woman, the inferior branch supplies the great labia, and is lost in the mons veneris ; the superior branch supplies the dorsum and summit of the clitoris.

#### SCIATIC NERVE.

The largest of all the nerves, terminating the sciatic plexus, all the branches of which contribute to form it. It passes out of the pelvis by the sciatic notch, between the pyramidalis and superior gemellus, descending along the posterior part of the thigh as far as the ham,



where it divides into two branches termed popliteal. *Relations*.—Anteriorly and from above downward with the gemelli muscles, the tendon of the obturator internus, quadratus femoris, and great adductor; posteriorly and in the same direction with the glutæus maximus, long portion of the biceps, semi-tendinosus, and fascia lata. *Branches*.—In its course it sends off twigs to the gemelli, obturator internus, quadratus, glutæus maximus, biceps, semi-tendinosus, semi-membranosus, adductor magnus, and to the skin.

#### EXTERNAL POPLITEAL NERVE.

It descends outward, behind the external condyle of the femur, then turns forward, and gets between the superior part of the fibula and peroneus longus muscle, and divides into two branches, the *musculo-cutaneous* and *anterior tibial*; near its origin it gives off a filament, which looks to the anterior and external part of the tibio-femoral and tibio-peroneal articulation. At the condyles it gives off another twig, which descends along the external and posterior part of the leg; it afterward descends, and gives off many twigs, which anastomose with the external saphena nerve, while others are lost in the integuments.

*Musculo-cutaneous branch*.—It descends anteriorly between the peroneus longus and extensor digitorum pedis, afterward between this latter and peroneus brevis; towards the middle of the leg it becomes superficial, and divides near the foot into two branches; the internal, which ramifies on the dorsum of the foot and superior surface of the first and second toe; the external advances on the middle of the back of the foot, and ramifies on the superior and internal surfaces of the second, third, and fourth toes.

*Anterior tibial branch*.—It descends in front of the interosseous ligament, with the anterior tibial artery, between the extensor communis digitorum pedis, tibialis anticus, and extensor proprius pollicis pedis; traverses the annular ligament of the tarsus, and divides on the dorsum of the foot into two branches;

1st, An internal, which is directed forward, between the two first metatarsal bones, and beneath the internal part of the extensor brevis digitorum pedis; it supplies the dorsal interosseous muscles and integuments, and sends twigs to the two first toes; 2d, An external branch, which ramifies in the extensor brevis digitorum pedis and interosseous muscles.

#### INTERNAL POPLITEAL NERVE.

It descends nearly vertically in the ham, passes between the gastrocnemii muscles, behind the articulation of the knee and the popliteus muscle, afterward between this latter and the soleus. After having traversed the semicircular opening of this latter muscle, it takes the name of the *tibial nerve*. This nerve descends along the leg, between the scalenus, which is posteriorly, and the tibialis posticus and flexor longus digitorum pedis, which are anteriorly; it is placed on the internal side of the tendo Achillis, and divides beneath the calcaneum into the internal and external plantar nerves. It gives off, above the internal condyle of the femur, the external saphena nerve, which descends on the middle part of the gastrocnemii muscles, afterward along the external border of the tendo Achillis; it passes behind the external malleolus, proceeds on the external superior part of the foot, as far as the posterior extremity of the fifth metatarsal bone, and divides into two branches, which are distributed to the fourth metatarsal bone and to the sides of the two last toes. In the ham, this nerve gives off twigs to the muscles of the superior part of the leg, and to the articulation of the knee; one of these twigs traverses the interosseous ligament, and is distributed to the anterior muscles of the leg. Near the internal malleolus it sends a small twig to the sole of the foot.

*Internal plantar branch.*—This proceeds directly forward, above the adductor proprius pollicis pedis, as far as the posterior extremity of the first metatar-

sal bone, and divides into four twigs for the four first toes, metatarsal bones, and interosseous muscles.

*External plantar branch.*—It is directed forward and outward, divides beneath the posterior extremity of the fifth metatarsal bone into two branches, the superficial and deep-seated; the former advances under the external border of the foot, and supplies the external border of the little toe, and the internal sides of the fourth and fifth toes; the latter passes inward and forward, between the interosseous muscles and abductor proprius pollicis pedis, and is distributed to these muscles.

## OF THE NERVOUS SYSTEM OF GANGLIA.

The ganglia are divided into those of the head and neck.

### 1st. GANGLIA OF THE HEAD.

#### LENTICULAR GANGLION.

[*Preparation.*—The same as for the ophthalmic nerve.]

*Situation.*—Applied against the outer side of the optic nerve, near its entry into the orbit. *Form.*—That of a square, elongated from before backward; very small. *Relations.*—On the outer side with the rectus externus muscle; on the inner side with the optic nerve. *Ramifications.*—Its postero-superior angle receives a filament from the nasal branch of the ophthalmic nerve; the postero-inferior, one from the third pair of nerves; its anterior angles furnish the ciliary nerves.

*Ciliary nerves.*—Very delicate, soft, and divided into two fasciculi; the upper fasciculus is formed of six nerves, which reach the globe of the eye above the optic nerve; the lower fasciculus is composed of six, eight, or ten nerves, which also arrive at the eye, and are situated on the outer and inferior side of the optic nerve. Having reached the posterior part of the orbit, the ciliary nerves, from twelve to sixteen in number, traverse the sclerotica, and proceed in a parallel direction between this latter membrane and the cho-

roid, and, reaching the ciliary ligament, each nerve divides into two twigs. Some of these latter twigs go to the ciliary processes.

#### GANGLION OF MECKEL.

[*Preparation.*—The same as for the upper maxillary nerve.]

*Situation.*—In the pterygo-maxillary fissure, on the outer side of the spheno-palatine foramen. *Form.*—Triangular, reddish, small, convex on the outer side, flattened on the inner. *Ramifications.*—This ganglion furnishes on the inner side the *spheno-palatine* nerves; inferiorly, the *palatine*; superiorly, the filaments of communication with the superior maxillary; and posteriorly, the *vidian* nerve.

1st, *Spheno-palatine nerves.*—Three to five in number; they penetrate the nasal fossæ by the spheno-palatine foramen, near the posterior extremity of the middle turbinated bone. Two or three filaments ramify on the concave surface of the superior turbinated bone, and in the corresponding meatus; others reach the middle turbinated bone, and others are distributed to the posterior part of the septum; the most considerable twig, termed the *naso-palatine*, is directed to the superior part of the septum narium, descends obliquely forward along the septum, between the two folds of the pituitary membrane, as far as the posterior orifices of the anterior palatine canal, into which it passes, and terminates in the naso-palatine ganglion.

2d, *Palatine nerves.*—Of these there are three: 1st, The larger palatine gives a filament which is distributed to the middle and inferior turbinated bones; it afterward enters the posterior palatine canal; furnishes, before its exit from the canal, another twig to the nasal fossæ, which is lost on the ascending process of the superior maxillary bone, and a filament, which is distributed to the velum palati. The nerve then leaves the canal, is directed forward under the palatine arch, and divides into twigs, which are lost in the alveolar processes and gums.

2d, *The middle palatine*.—It descends along the posterior part of the pterygo-maxillary fissure, and divides into two filaments, one of which ramifies on the amygdalæ and velum palati, and the other on the velum only.

3d, *The lesser palatine*.—It is situated between the external pterygoid muscle and maxillary bone, afterward between this latter and the palatine bone, and is divided into two twigs, one for the uvula, the other for the amygdalæ and mucous follicles.

*Vidian nerve*.—It is directed horizontally backward, passes through the pterygoid canal, giving filaments to the neighbouring parts, and divides into two branches; 1st, *Inferior, or carotid branch*.—It descends into the carotid canal, applied against the walls of the artery, and anastomosing with the filaments of the superior cervical ganglion; 2d, *Superior branch*.—This enters the cranium between the petrous portion of the temporal bone and the sphenoid, and is directed backward and outward on the superior surface of the former bone, where it is lodged in a small groove, covered by the inferior maxillary nerve and dura mater, to which latter it adheres; it glides then with a small artery into the hiatus Fallopii, and, arriving at the aqueduct of Fallopius, is applied against the trunk of the facial nerve; penetrates into the cavity of the tympanum, traverses it from behind forward, placed at first under the incus, afterward between its long portion and the superior part of the handle of the malleus. Above the tensor tympani it enlarges, descends forward, and comes out by the glenoid fissure; it is then directed downward, inward, and forward, and is applied to the lingual nerve of the inferior maxillary. It is termed the corda tympani, from its entry into the cranium to its union with this latter nerve; it then leaves the lingual nerve, on a level with the sub-maxillary gland, to gain the ganglion of the same name.

The other ganglia of the head, according to H. Cloquet, are the *cavernous, naso-palatine, and sub-maxillary*.—The former is situated in the sinus of the

same name; it is very small, and gives filaments to the external motor and ophthalmic nerves. The naso-palatine is seen in the anterior palatine foramen; it receives the naso-palatine nerves, and gives off inferiorly one or two filaments, which ramify on the palatine membrane. The sub-maxillary seems to be formed by the superior branch of the vidian nerve, situated on a level with the sub-maxillary gland, into which most of its filaments enter.

#### GANGLIA OF THE NECK.

[*Preparation.*—We begin by removing the arch of the cranium, the zygomatic arch, the parotid gland, the masseter muscle, the lower part of the temporal muscle, the ramus of the jaw, and the two pterygoidei muscles, being careful not to cut the facial nerve. We divide the sterno-mastoideus muscle near its lower insertion, and turn it outward; we then dissect the digastrici muscles, and those which are attached to the styloid process; we divide this process near its base, and turn it back, with the muscles which are attached, near the anterior part of the neck; we then look for the superior cervical ganglion on the rectus capitis anticus muscle, behind, and a little on the outside of the internal carotid artery. We follow the filaments which ascend in the carotid canal and the cavernous sinus, by making in the skull the following incisions: saw the bones of the skull on one side, from the anterior part of the external auditory passage to the inner extremity of the petrous portion of the temporal bone, and on the other side from the external orbital process of the frontal bone to the superior maxillary foramen. We divide the great wing of the sphenoid bone from before backward. We can then, with a large scalpel, open the carotid canal, and also the cavernous sinus, and discover the ascending branches of the superior cervical ganglion, and also the vidian nerve. If we follow the lower filament of this ganglion we come to the middle ganglion, and from this we can find the inferior cervical ganglion by tracing the intermediate filaments.]

#### SUPERIOR CERVICAL GANGLION.

*Situation.*—Beneath the base of the brain, in a depression observed above and behind the angle of the inferior maxilla; extending from the inferior orifice of the carotid canal as far as the third cervical vertebra. *Form.*—Elongated, somewhat oval, soft, and of a grayish-red colour. *Relations.*—Posteriorly with the rectus capitis anticus; anteriorly with the inter-

nal carotid artery; on the inner side with the par vagum and ninth pair. *Ramifications*.—It gives off superior, inferior, internal, external, and anterior filaments. The superior are two in number; these mount into the carotid canal, and anastomose with the superior twig of the vidian nerve, with the sixth pair in the cavernous sinus, with a filament from the glosso-pharyngeal, and by other twigs with the ophthalmic and nasal branches. It gives off a filament, which unites with the lower filament of the vidian nerve; two or three, which are soft and transparent, to the external motor nerve, in the cavernous sinus; another filament, which unites in this sinus with the ophthalmic and nasal nerves; and some also which form a sheath around the carotid artery, and accompany its ramifications. The inferior filaments descend and pass in front of the anterior recti and longus colli muscles, covered by the carotid artery, internal jugular vein, eighth and ninth pair, and terminate on a level with the fifth or sixth vertebra, in the middle cervical ganglion. It gives some twigs to anastomose with the external laryngeal nerve, and two or three others, which enter the chest, and concur in forming the cardiac plexus. The external, internal, and anterior filaments anastomose, the first with twigs from the cervical nerves around the transverse process of the atlas; the second send filaments to the rectus capitis and longus colli muscles, and terminate in the larynx and pharynx; they anastomose with the glosso-pharyngeal and eighth pair, forming the pharyngeal plexus; and the third with the eighth pair and facial, forming a plexus for the primitive carotid. Finally, the last twigs of the superior cervical ganglion unite to form the superior cardiac nerve.

#### MIDDLE CERVICAL GANGLION.

It varies in size, and sometimes does not exist; it is situated on a level with the fifth or sixth cervical vertebra, near the curve of the inferior thyroid artery; its form is lenticular, and it is in relation, anteriorly,



with the carotid artery, internal jugular vein, and eighth pair; posteriorly with the longus colli. Its inferior filaments, often five or six in number, descend before and behind the subclavian artery, and terminate in the inferior cervical ganglion. The external anastomose with the seventh pair of lumbar nerves; the inferior form a plexus around the inferior thyroid artery, and give filaments to the thyroid gland, œsophagus, trachea, and recurrent nerve; and one to the phrenic nerve. Its anterior filaments form the middle cardiac nerves.

#### INFERIOR CERVICAL GANGLION.

Of an irregular figure, semilunar, situated behind the vertebral artery, between the transverse process of the seventh vertebra and neck of the first rib. The superior filaments form a plexus on the vertebral artery, which sends filaments to the inter-transversarii muscles, and anastomoses by a special filament with each of the cervical nerves. The inferior filament communicates with the thoracic ganglion. The internal go to the longus colli muscle, the pulmonary plexus, or on the curve of the aorta on the left side. The external filaments form a plexus around the subclavian artery; other filaments anastomose with the last four cervical pairs. The anterior form the inferior cardiac nerves.

#### CARDIAC NERVES.

Of these there are three on each side, terminating in the cardiac plexus. The *superior cardiac nerves*.—Those of the right side are formed by five or six filaments, which come from the superior cervical ganglion, descend along the neck on the side of the trachea and thyroid gland, penetrate the chest behind the subclavian vein, and receive twigs from the inferior cervical ganglion and recurrent of the eighth. Those of the left side descend between the primitive carotid and subclavian arteries, and pass on the aorta to unite to those of the inferior cardiac nerve.



*The middle cardiac.*—That of the right side is larger than the two others of the same side; it arises from the middle cervical ganglion by five or six filaments, descends inward near the primitive carotid, anastomosing with the recurrent, and terminating in the cardiac plexus. That of the left side receives its principal twig from the inferior cervical ganglion, descends behind the subclavian artery, and passes behind the arch of the aorta. *The inferior cardiac.*—The filaments which form that of the right side come from the inferior cervical ganglion, and proceed on the anterior side of the arch of the aorta as far as the cardiac plexus. The middle and inferior cardiac nerves, on the left side, are united into a single trunk.

#### CARDIAC PLEXUS.

*Situation.*—Behind the arch of the aorta, near the origin of this artery. *Form.*—Elongated, tortuous. It extends from the origin of the brachio-cephalic artery to the bifurcation of the pulmonary artery. *Ramifications.*—It receives the cardiac nerves, and furnishes, anteriorly, posteriorly, and inferiorly, a great number of filaments. The anterior ramify on the anterior part of the aorta; the posterior terminate in the pulmonary plexus. Some of the inferior embrace the ductus arteriosus, and left pulmonary artery; a larger filament gains the posterior part of the heart, interlacing its twigs around the posterior coronary artery, and forming the coronary plexus; other filaments are directed towards the anterior part of the base of the heart, and form the anterior coronary plexus, and accompany the artery of the same name.

#### 3. THORACIC GANGLIA.

*Number.*—Twelve on each side. *Situation.*—In front of the head of each rib, in the intercostal spaces, underneath the pleura. *Form.*—Oblong. *Ramifications.*—They communicate by filaments, and give off external and internal twigs. The filaments of com-

munication are voluminous, frequently equal to the size of the ganglia themselves; extending from the inferior part of one ganglion to the superior part of the other; are never multiplied or ramifying between the neighbouring ganglia; the intercostal arteries generally pass between them. The external twigs anastomose with each of the anterior branches of the dorsal nerves at the moment of their exit from the holes of conjugation. Some of the internal concur to the formation of the splanchnic nerves; others interlace on the vertebral column, or go to the pulmonary plexus; one of them descends on the aorta.

#### SPLANCHNIC NERVES.

Of these there are two on each side, distinguished into the great and small.

*Great splanchnic nerve.*—It arises from the internal part of the sixth, seventh, eighth, ninth, and sometimes tenth thoracic ganglion, by four or five roots, which descend inward on the sides of the vertebral column, and unite into a single trunk on a level with the eleventh dorsal vertebra; this nervous cord enters the abdomen, across a separation of the fleshy fibres of the diaphragm, applied on the vertebral column, passes behind the stomach a little above the surrenal capsule, and terminates in the semilunar ganglion.

*Small splanchnic nerve.*—It is formed by two branches, which come from the tenth and eleventh thoracic ganglia, which unite again on the twelfth dorsal vertebra into a small cord, which enters the abdomen, and anastomoses with the former, and terminates in the renal ganglion.

#### GANGLIA OF THE ABDOMEN.

[*Preparation.*—After opening the abdomen, turn the liver upward and to the right, divide transversely the gastro-hepatic epiploon, turn the stomach upward to the left, and raise the lower end of the spleen from before backward.]

*Number.*—One on each side. *Situation.*—Partly on

the pillar of the diaphragm, and partly on the aorta; on a level with the cœliac artery, above and a little behind the surrenal capsule. *Form.*—Larger than all the other ganglia, oblong, concave superiorly, convex inferiorly. *Ramification.*—By the superior and external extremity, it receives the great splanchnic nerves; by the inferior, it communicates with that of the opposite side. The two semilunar ganglia are surrounded by a number of others, varying in number and volume, communicating freely with one another by short filaments, from which the solar plexus is formed. This latter lies on the vertebral column, the aorta, and pillars of the diaphragm, and is concealed by the stomach anteriorly, the liver and diaphragm superiorly, and the pancreas inferiorly; it receives some twigs from the eighth pair of nerves, and furnishes numerous twigs, which accompany all the divisions of the aorta in forming secondary plexuses.

1. *Diaphragmatic plexus.*—It comes from the upper part of the solar plexus, and is composed of a small number of filaments, which accompany the inferior diaphragmatic arteries. 2. *Cœliac plexus.*—This is a prolongation of the lower part of the solar plexus. This plexus receives filaments from the phrenic and pneumogastric nerves, and divides into three others, which accompany the coronary artery of the stomach, the hepatic, and splenic artery. 3. *Coronary plexus of the stomach.*—It surrounds and attends the coronary artery in its course along the small curve of the stomach, and is distributed to its tunics, communicating with some filaments of the pneumogastric nerve. The *hepatic* plexus is very large, composed of a great number of nervous filaments, which embrace the hepatic artery and the vena portæ like a sheath, and accompany the branches of the vessels in the substance of the liver. It also gives some filaments to the ductus hepaticus et choledochus, to the gall-bladder, duodenum, great curve of the stomach, and great epiploon. *Splenic plexus.*—Formed by a small number of filaments, which embrace the splenic

artery, and follow its branches into the substance of the splcen. It gives off some filaments to the pancreas, others which accompany the left gastro-cpiploic artery, and go to the left part of the stomach and great epiploon. 3. *Superior mesenteric plexus*.—It comes from the aorta, descends with the superior mesenteric artery between the pancreas and the duodenum, enters between the two layers of the mesentery, and forms a network, the meshes of which embrace the lymphatic ganglions, and follow all the twigs of the artery. This plexus sends some filaments to the pancreas, duodenum, right lumbar colon, and cœcum. 4. *Inferior mesenteric plexus*.—It extends from the aorta on the inferior mesenteric artery, around the origin of which it forms a narrow sheath. Near the margin of the pelvis this plexus gives off an inner portion, which surrounds the primitive iliac artery, and sends some twigs along the external iliac and the hypogastric artery; the plexus then accompanies the mesenteric artery and its branches into the mesentery. 5. *Renal plexus*.—It is given off by the solar plexus and the small splanchnic nerve, and sometimes contains several small ganglions; they accompany the renal artery and vein, and their branches, into the substance of the kidney. Some filaments follow the capsular artery. 6. *Spermatic plexus*.—It comes from the renal plexus, and is formed by a few twigs, which follow the spermatic arteries to the testicle in the male, and to the ovary, or Fallopian tube, in the female.

#### LUMBAR GANGLIA.

*Number*.—Five on each side; sometimes only two or three. *Situation*.—On the anterior and lateral parts of the body of the lumbar vertebræ, near the great psoas muscle. *Form*.—Oblong. *Ramifications*.—They give off branches of communication, and internal and external filaments. These branches send filaments to those which come from the aorta, and are continuous with the corresponding ones coming from

the *sacral ganglia*, and concur in the formation of the hypogastric plexus.

#### SACRAL GANGLIA.

Of these there are three or four on a side ; they are situated on the anterior face of the sacrum. They differ in form, and communicate with each other by filaments, which vary in size, and give external, internal, and anterior filaments, which contribute to form the hypogastric plexus.

*Hypogastric plexus*.—This is composed of numerous filaments from the *vesical, uterine, vaginal*, and hæmorrhoidal nerves, and of a great number of the anterior twigs of the sacral ganglia. It gives ramifications to the rectum, vesiculæ seminales, bladder, uterus, vagina, and anus, and to the arteries which go to these organs.

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## CLASS II.

### SYSTEM OF THE LIFE OF NUTRITION.

#### ORDER I.

##### DIGESTIVE APPARATUS.

#### ARTICLE I.

##### PARTS CONSTITUTING THE DIGESTIVE APPARATUS IN GENERAL.

The digestive apparatus is composed of mucous, muscular, and serous membranes. We shall describe each of these parts in detail when treating of the structure of the different digestive organs. We shall here treat very briefly of the mucous system, the muscular, and serous system of nutritive life, leaving out of view the digestive, respiratory, circulatory, and secretory organs, &c., of which they make part.

## OF THE MUCOUS MEMBRANE GENERALLY.

The term mucous membrane is applied to membranes of a rosy white, which are continuous with the skin, and line all the cavities opening on the outside of the body, and thus form an internal tegument, as it were. They are divided into two parts; one which covers the interior of the digestive and respiratory system, even in their minutest divisions, the *gastro-pulmonary mucous membrane*; the other, which lines the urinary and genital organs, or the *genito-urinary mucous membrane*. The form of the mucous membrane is the same as that of the organs they cover. These membranes form folds in several parts, which on the intestines are true valves, termed the *valvulæ conniventes*. The inner surface of these membranes is free, smooth, soft, and constantly moistened by a diaphanous and viscid fluid, termed *mucus*. It presents small prominences, termed *villosities*, *papillæ*, and small depressions formed by mucous follicles. The *papillæ* are small conical eminences, which are seen particularly on the surface of the tongue, glans, clitoris, and a few in other parts. The *villosities* are small openings, which, when agglomerated, give the appearance of velvet to the mucous membrane. They belong perhaps exclusively to the gastro-intestinal mucous membrane. The external surface is very intimately united to a dense layer of cellular tissues, which is often improperly termed a *nervous tunic*.

*Organization.*—This varies in different parts of the system. It is generally analogous to that of the skin. The mucous membranes, however, have no reticular body. The two layers which compose it, at least in a part of their course, correspond to the chorion and to the epidermis. This latter membrane, which is here termed the epithelium, is appreciable only from the mouth to the end of the œsophagus, from the vulva to the neck of the uterus. In every other part the mucous membranes are formed by a single layer, a kind of chorion, or derma, which is soft, thin, spongy,

and very vascular, and well supplied with nerves, which, in the parts where papillæ exist, unite to the capillary bloodvessels and sanguineous capillaries, which frequently anastomose. The mucous membranes contain in their tissue small glands, termed the muciparous glands, the mucous follicles, which are formed, like those of the skin, by a depression of the membrane, and which represent very small cysts, with a narrow neck, open on the free surface of the membrane by an infundibuliform orifice.

*Vital properties and functions.*—The mucous membranes are generally sensible; but this sensibility varies in different parts of their course. It is very great at their origin, near the external openings, but diminishes as we retreat from the periphery, and becomes slight in the internal organs. The mucous membranes have common and special functions; first, they are the seat of different absorptions, and of secretions of serum and mucus. Second, they contribute to the functions peculiar to the organs of which they make a part, to digestion in the stomach, to respiration in the lungs, &c.

## 2. OF THE MUSCULAR SYSTEM OF NUTRITIVE LIFE.

This system embraces the heart, and the planes of muscular fibres which encircle the internal integuments and their brachial, genital, and urinary prolongations. The use and form of these parts depend on the volume and form of the hollow organs which they contribute to form. They represent layers of various densities, which are generally circular. The fibres which compose this system are pale and grayish, which sometimes intercross, and are sometimes in juxtaposition, and united in flattened fasciculi. Most of those which compose the digestive canal are transverse. In the œsophagus and large intestines, however, the fasciculi are longitudinal. The internal muscles, however, have but little cellular tissue; their vessels are more numerous than those of the involuntary muscles. Their nerves come from the pneu-



mogastric nerve and from the ganglionic system. The sensibility of these muscles is very slight, their motility is not subject to the will; it is excited by certain special stimulants, to wit: chyme, chyle, feces for the digestive canal, the blood for the heart, the urine for the bladder, &c. It is also brought into action by numerous moral influences and pathological causes.

### 3. OF THE SEROUS MEMBRANES.

The serous membranes are very thin, transparent, and extensible. They have the form of a sac without an opening. They have two surfaces; an external, which adheres to the adjacent parts more or less intimately, according to the parts examined; and the internal, which is free, perfectly loose, shining, and lubricated by a liquid analogous to the serum of the blood: hence the name of serous membrane. The membranes which compose this system are the peritoneum, the arachnoid membrane, the pleuræ, the pericardium, the tunica vaginalis. They are formed by a single layer, which seems to be constituted by a special cellular layer, the texture of which is very compact. The serous system is insensible in the state of health. The functions of this system are to separate the organs they line, and between which their cavity is interposed, and also to facilitate, by the serum contained in their cavity, the different motions of dilatation, collapse, &c., performed by the different organs covered by these membranes.

### - OF THE DIGESTIVE ORGANS.

The organs which compose this system are, 1st, The mouth, pharynx, and œsophagus, or the organs of mastication and deglutition; 2d, The stomach, large and small intestines, or the organs of chymification, chylication, and of the excretion of fecal matter. *Mouth*.—It is situated between the two jaws, below the nasal fossæ, in front of the pharynx. *Form*.—An oval cavity, in which we distinguish six



parietes. *Direction.*—Horizontal. *Organization.*—The mouth is lined by a mucous membrane; its parietes are formed by the lips, velum palati, tonsils, cheeks, palate, and tongue. 1st, *Buccal mucous membrane.*—Superiorly this membrane covers the posterior face of the upper lip, where it forms the *frenum of the upper lip*, is reflected on the alveolar arch, covers the palatine arch, and then passes on the velum palati. Inferiorly it lines successively the posterior face of the lower lip, forming its frenum; the anterior and posterior faces of the body of the lower maxillary bone, the entire surface of the tongue, forming the frenum of this organ near the symphysis; it is continuous farther on with the membrane of the larynx and that of the pharynx; on the sides it lines the cheeks, in the centre of which we see the parotid duct, and forms posteriorly the pillars of the velum palati, and covers the tonsils.

*Lips.*—These are situated in front of the two jaws, and are distinguished into an upper and lower lip. They are symmetrical, flattened from before backward, and are separated by a transverse fissure, which is the anterior opening of the mouth. Its anterior face is convex; the posterior is concave, and rests on the alveolar and dental arches, and presents the frenum of each lip. The edge is free, convex, rounded, red, covered with a well-marked epidermis; the two extremities of the edge of one lip unite with those of the edge of the other, to form the angles or the commissures of the lips. *Organization.*—The lips are composed, 1st, By a fine and delicate dermoid layer, attached to the subjacent parts by a cellular tissue, which contains no fat, and is covered in the adult with more or less hair, which makes part of the beard; 2d, By a muscular layer described above; 3d, Finally, by a mucous layer, remarkable for its redness, and its epidermis, which is very marked, is adapted to numerous muciparous follicles, termed the *labial glands*, the excretory canals of which open on the posterior face of the lips. The arteries of the lips come from the external carotid; their veins

empty into the jugular vein; their nerves arise from the infra-orbital, the mental, and the facial.

#### VELUM PENDULUM PALATI.

*Situation.*—On the posterior border of the palatine arch, between the mouth and pharynx, which it separates. *Form.*—A moveable, soft, quadrilateral septum, divided into two faces and two borders. The anterior face presents at its middle part a slight prominence; the superior is smooth and plane. The superior border is attached to the palatine arch, and the anterior is free and floating, and presents in its centre a conical appendix, the *uvula*, and at its extremities the pillars of the velum, which are divided into anterior and posterior; the former are directed obliquely forward, the latter vertical; separated by a triangular interval, which lodges the tonsils, which are of an ovoid form. *Organization.*—The velum palati is formed, 1st, By a mucous layer, which forms a duplicature, in which the muscular layer is situated; it is continuous with the membrane of the mouth and that of the nasal fossæ, and is composed of two folds; of these, the anterior is less red, and covers numerous mucous follicles, which are very compact, yellow, and rounded; 2d, By a muscular layer, the muscles of which have been described. The arteries of the velum come from the external carotid; its veins go to the internal jugular; its nerves are given off by the ganglion of Meckel and the glosso-pharyngeal nerve.

#### TONSILS OR AMYGDALÆ.

*Situation.*—Between the pillars of the velum palati. *Form.*—Ovoid, the large extremity turned upward. *External surface.*—Adherent to the superior constrictor of the pharynx. *Internal surface.*—Free and prominent, forming the sides of the isthmus faucium. *Anterior side.*—Applied against the constrictor isthmii faucium. *Posterior side.*—In contact with the palato-pharyngeus muscle. *Organization.*—They are of a

grayish colour, divided into very many lobes, formed of a tissue apparently pulpy; presenting interiorly small cells, which open on their internal surface by excretory ducts. The arteries of the tonsils come from the external carotid artery, and its nerves from the glosso-pharyngeal and lingual nerves.

#### CHEEKS.

These are the sides of the mouth. *Organization*.—*Dermoid layer*.—Very fine, covered partly with a beard in an adult. *Muscular layer*.—Formed by the muscles already described. *Mucous layer*.—Thinner than in the other parts of the mouth, covering a great number of buccal glands, and posteriorly two small bodies, formed by the agglomeration of mucous glands, and termed molar glands; their excretory orifice is opposite the last molar tooth. The arteries of the cheeks come from the external carotid, and its nerves from the superior and inferior maxillary, and from the facial nerves.

#### PALATE.

This forms the upper wall of the mouth. *Organization*.—Its bony portion is formed by the superior maxillary and palate bones already described. *Mucous membrane*.—It is denser, thicker, and less red than the other parts of the mouth, presenting anteriorly transverse folds, smooth in the rest of its extent; presenting foramina, which are the excretory orifices of the mucous follicles which are situated under it; it is continuous, anteriorly and on the sides, with the gums. The latter are formed by a reddish, firm, and resisting tissue, which covers the two sides of each alveolar arch, and exactly fills the intervals which exist between the teeth. The arteries of the palate and gums are given off by the external carotid artery, and their nerves by the maxillary, the facial, &c.

#### TONGUE.

This has already been described.

## PHARYNX.

*Situation.*—Behind the nasal fossæ, the mouth, and the larynx, in front of the vertebral column. *Form.*—That of a musculo-membranous canal, broader in its middle portion than at its extremities. It is bounded superiorly by the basilar process of the occipital bone; inferiorly, it unites with the œsophagus; anteriorly, in relation with the nasal fossæ; posteriorly, resting against the vertebral column, recti antici, and longus colli muscles; laterally, in contact with the internal carotids, internal jugular veins, and eighth pair of nerves. Superiorly, the pharynx is attached to the basilar process of the occipital bone by an aponeurosis; and at the superior part of the internal lateral sides, we observe the Eustachian tube. Inferiorly, its separation from the œsophagus is marked by a contraction in its calibre, and by a remarkable change in the direction of its fibres.

## ŒSOPHAGUS.

It is situated at the anterior and inferior part of the neck, and the posterior and middle part of the chest. It extends from the lower part of the pharynx to the upper orifice of the stomach. *Form.*—It is a musculo-membranous canal, which is cylindrical, slightly compressed from before backward. *Direction.*—Vertical, presenting some slight inflections. A musculo-membranous canal, of a cylindrical form, slightly compressed from before backward. *Relations.*—1st, In the neck, anteriorly with the larynx, left lobe of the thyroid gland, left inferior thyroid vessels, and sterno-thyroid muscle; posteriorly with the anterior vertebral ligament and longus colli muscle on the left side; laterally with the primitive carotids and internal jugular veins; on the right side with the trachea, and on the left with the recurrent nerve and carotid of that side; 2d, In the chest, anteriorly, a little with the trachea, afterward with the left bronchus, the

base of the heart, the posterior part of the pericardium; posteriorly with the vertebral column, the curve of the vena azygos, the thoracic canal, and inferiorly with the aorta; laterally with the lungs, and with the aorta on the left side. *External face*.—Smooth, reddish above, whitish below, presenting longitudinal striæ. *Internal surface*.—Smooth, whitish, and folded. *Organization*.—Its muscular layer is composed of two planes of fibres, the one external, the other internal; the fibres of the first are longitudinal, diverging, and separating near the stomach, where they become contiguous with those of this organ; the fibres of the internal plane are transverse and circular, and cease abruptly at the stomach. Its mucous membrane is soft and whitish, covered with longitudinal folds, under which are a few mucous follicles. The arteries of the œsophagus come from the external carotid artery, and from the aorta; its nerves are given off by the pharyngeal and pulmonary plexuses, the cardiac and pneumogastric nerves, &c.

#### STOMACH.

*Form*.—A conoid, elongated, musculo-membranous reservoir, slightly flattened on its two surfaces, continuous above with the œsophagus, below with the duodenum. *Direction*.—Nearly transverse, a little obliquely downward, to the right side, and forward; divided into two surfaces, two curved borders, and two extremities, presenting each an opening. *Exterior surface*.—*Anterior face*.—Convex, turned a little upward, in relation from left to right with the false ribs, diaphragm, and left lobe of the liver. *Posterior face*.—Flattened, directed a little backward, corresponding to the transverse mesocolon. *Anterior border, or great curve*.—Convex, in relation with the transverse arch of the colon, lodged in the separation of the folds of the great omentum. *Posterior border, or little curve*.—Concave, corresponding to the aorta, great fissure of the liver, and placed between the two folds of the gastro-hepatic epiploon or lesser omentum.

Superiorly, and on the left side, lies the cardiac orifice, placed beneath the diaphragm, surrounded by a circle formed of the coronary artery and vein, and extremities of the œsophageal branches of the eighth pair; inferiorly, and on the right side, is the pyloric orifice, lower and more anterior than the former; it generally ascends backward and a little to the right side; it corresponds superiorly and anteriorly with the liver, inferiorly and posteriorly with the pancreas, posteriorly with the right gastro-epiploic artery, and on the right side with the neck of the gall-bladder.

The stomach is composed of three membranes; 1st, *Serous tunic*.—Formed by the peritoneum, not existing along the curvatures when the stomach is empty; united to the muscular tunic by loose cellular tissue, except at its middle part. 2d, *Muscular tunic*.—United on the inner side to the mucous membrane by dense cellular tissue, formed of three species of whitish muscular fibres; the first, longitudinal and superficial, are continuous with those of the œsophagus, and follow the two curvatures; the second are circular, more numerous at the middle portion of the stomach than at its extremities, parallel to one another, not forming a complete circle round the organ; the third are oblique, and are spread, the one on the left side of the cardia, on the two surfaces of the stomach, and the others on the right side of the same orifice, and on the great end. 3d, *Mucous tunic*.—We observe between this and the preceding the mucous follicles (glands of Brunner). The narrow extremity of the pylorus presents the pyloric valve, a circular, flattened thickening, with the small circumference thin and floating, and the great one constituting a white, fibrous, solid ring, formed by a fold of the mucous and muscular tunics. This tunic presents numerous wrinkles, is of whitish rosy colour, and is covered with a viscid fluid coming from the follicles. *Nervous tunic*.—This is nothing more than the cellular tissue which unites the muscular and mucous tunics, having a looser texture for the free passage and ram-

ification of vessels. The arteries of the stomach come from the coronary arterics, from the two gastro-epiploic, from the pyloric, and from the splenic. Its veins terminate in the vena portæ; its lymphatic vessels go to the ganglions placed along its curves; its nerves come from the pneumogastric and celiac plexuses.

#### SMALL INTESTINES.

Commence at the stomach and terminate at the cœcum. They are divided into three parts. 1st, *Duodenum*.—It occupies the middle deep part of the abdomen, concealed by the transverse mesocolon and stomach; it is larger than the other parts of the small intestines, and is continuous superiorly with the pyloric end of the stomach. *Direction*.—Its first portion passes horizontally backward and to the right side, forming an angle at its union with the second portion; this descends vertically and a little to the left as far as the third lumbar vertebra; the third portion is continuous with the latter, passes transversely to the left side, in front of the vertebral column, and, directed upward and forward, terminates towards the upper extremity of the mesentery. *Relations*.—Superiorly with the neck of the gall-bladder and with the liver; inferiorly with the inferior fold of the transverse mesocolon; posteriorly with the anterior and lateral parts of the right side of the vertebral column, right kidney, inferior vena cava, aorta, and right pillar of the diaphragm. Interiorly, the duodenum presents the valvulæ conniventes, circular folds of the mucous membrane, parallel to one another, and of variable size and length; and at the union of its second and third portions we observe a small eminence, pierced by the united or separate orifices of the ductus communis choledochus and pancreatic duct. Its muscular and other tunics resemble that of the stomach. The arteries of the duodenum come from the superior mesenteric, from the pyloric, the gastro-epiploic, &c.; and its nerves from the solar plexus.

*Jejunum and ileon, or small intestines properly so called.*—They occupy the umbilical, hypogastric, and a part of the iliac regions, and a part of the cavity of the pelvis. They form a long canal, which is continuous with the duodenum, and which terminates in the cæcum; the anterior part is convex, presenting those numerous convolutions observed in the above regions; the posterior adheres to the mesentery, and is concave. *Length.*—Nearly four or five times that of the body. *Relations.*—Anteriorly with the great epiploon or omentum, and the anterior wall of the abdomen; posteriorly with the vertebral column, around its circumference with the large intestine. *Organization.*—Similar to the parts already mentioned; the valvulæ conniventes are very numerous, and gradually diminish from above downward. *Organization.*—1. *Serous tunic.*—It covers all the surface of the small intestine, except posteriorly, where the peritoneum, in forming the mesentery, leaves a triangular space. 2. *Muscular tunic.*—United on the outside to the peritoneum, on the inside to the mucous membrane, formed by pale fibres, some of which are superficial and longitudinal, while others are more distinct and transverse. 3. The mucous tunic is somewhat thicker than that of the stomach, forming valvulæ conniventes, and presenting numerous and very apparent villousities, and a great number of mucous follicles, termed the *glands of Peyer*, which project slightly into the intestine. The arteries of the small intestine come from the superior mesenteric; its veins go to the vena portæ; its nerves arise from the superior mesenteric plexus. Anatomists have endeavoured to divide the small intestines into two portions, without being able to assign to each its respective limits; of these two, the superior has been named the *jejunum*, which occupies the two superior fifths of the small intestines; the other the *ileon*, occupying the rest of their extent.

*Large intestines.*—These are divided into the *cæcum*, *colon*, and *rectum*. *Cæcum.*—*Situation.*—In the right iliac fossa. *Form.*—Irregularly triangular, three times



the size of the small intestines, continuous with the ileon and colon. *Relations*.—Anteriorly with the parietes of the abdomen; posteriorly with the psoas and iliacus muscles of the right side; on the inner side with the small intestine, which is inserted into it at an acute angle inferiorly. *Exterior surface*.—This presents three prominent portions, separated by three longitudinal depressions, one of which is anterior, the other two posterior; inferiorly we observe the processus vermiformis, which is cylindrical and of the size of a writing-quill, about two or three inches long; its cavity communicates with the cæcum. *Internal surface*.—This presents inferiorly and at its left side the orifice of the ileon, provided with the *ileo-cæcal valve*, which is elliptical, adhering by its convex border, directed transversely, and with its concave edge free in the cavity of the cæcum. *Organization*.—The serous tunic, or peritoneum, covers entirely the inferior portion and a part of the superior; it then leaves it to pass on the parietes of the abdomen, sometimes forming a fold termed the *meso-cæcum*. *The muscular tunic* is composed of circular and longitudinal fibres similar to those of the small intestines; the longitudinal form three distinct bands, which occupy the longitudinal grooves of its external surface. *The mucous membrane* forms no valvulæ conniventes. The ileo-cæcal valve is formed by the mucous tunic folded on itself. Its lower lip contains a plane of fleshy fibres. The vermiform appendage has the same structure as the cæcum. *Colon*.—This extends from the right iliac region to the left, and is divided into four portions; 1st, *Ascending portion*.—Extends from the cæcum as far as the border of the corresponding false ribs. *Relations*.—Anteriorly with the peritoneum and small intestines; posteriorly with the quadratus lumborum and right kidney; on the inner side with the inferior fold of the transverse mesocolon, and right fold of the mesentery; on the outer side with the parietes of the abdomen. 2d, *Transverse portion, or arch of the colon*.—Extending from one hypogastric region to the

other; in the antero-inferior part of the epigastric region, beneath the stomach. *Relations*.—Superiorly with the liver and anterior border of the stomach, and on the left side with the spleen; inferior surface, applied on the small intestines; anterior border, embraced by the omentum; the posterior by the transverse mesocolon. 3d, *Descending portion*.—Commencing beneath the spleen, and in all respects similar in its relations to the ascending portion. 4th, *Sigmoid flexure*.—In the left iliac fossa, terminating at the superior part of the pelvis, near the sacro-vertebral articulation. *Relations*.—Anteriorly with the small intestines; posteriorly with the psoas and iliacus muscles, spermatic vessels, and ureter. *Organization*.—1st, *Serous tunic*.—Formed by the peritoneum, which covers the intestine, and attaches it to the adjacent parts by two large folds, which are the transverse mesocolon and the iliac mesocolon. 2d, *Muscular and mucous coats*.—Similar to those of the cæcum. The arteries of the cæcum and colon come from the mesenteric, and their veins open into the vena portæ; the nerves come from the mesenteric plexuses.

Interiorly the colon presents the same disposition as the cæcum.

#### RECTUM.

Continuous with the sigmoid flexure of the colon, extending from the left sacro-vertebral articulation to the summit of the os coccygis; at first a little inclined from left to right, afterward nearly vertical. *Relations*.—In man, inferiorly and in front with the fundus of the bladder, the prostate gland, and vesiculæ seminales; in woman, with the vagina, which is united to it by a vascular network; anteriorly with the peritoneum in both sexes, and immediately in woman with the uterus; in man with the body of the bladder; posteriorly, in both sexes, with the sacrum and os coccygis, from which it is separated by the hypogastric vessels and nerves; laterally with a quantity of cellular tissue and the levatores ani. *In-*

*ternal surface*.—Smooth superiorly ; presenting inferiorly numerous parallel longitudinal wrinkles, between which some semilunar membranous folds are observed, forming species of lacunæ. The inferior extremity of the rectum terminates in the anus, which is placed about an inch in front of the os coccygis. *Organization*.—The peritoneum does not exist at its inferior part ; superiorly it forms the meso-rectum. Its muscular tunic consists of two planes of fibres ; the superior and superficial are longitudinal ; the inferior and deep-seated, circular ; the latter form the sphincter ani internus. The mucous tunic is similar to that of the other parts of the digestive tube, forming folds and wrinkles on the inner face of the intestine, presenting the orifices of the mucous follicles. The arteries of the rectum come from the inferior mesenteric, the hypogastric, and the internal pudic artery ; its nerves come from the sciatic and hypogastric plexuses.

#### PERITONEUM.

This is a thin, transparent, serous membrane, having the form of a sac without an opening ; covering the internal surface of the parietes of the abdomen, and most of the organs it contains, without including any of them in its proper cavity, and forming numerous folds destined to maintain the different parts in their respective situations. To render the study of its course in the abdomen more easy, it is divided into three regions : a superior or epigastric, a middle or umbilical, and an inferior or hypogastric. These regions are separated by two lines, one of which passes on the lower edge of the twelfth rib of each side, and the other extends between the two crests of the ilium. Each of these regions is divided into three others by two lines, which are supposed to descend vertically from the lower part of the thorax to the anterior and superior iliac spines. The middle region of the upper zone is termed the epigastrium, and its lateral regions the hypochondria ; the middle region of the middle zone is termed the umbilicus,

and its lateral regions the flanks or sides ; the middle region of the lower zone is termed the hypogastrium, and its lateral regions the iliac fossæ. The peritoneum is divided into three portions, which correspond to these three great regions.

1st, *Umbilical portion*.—Commencing at the linea alba, it covers, on the right and left side, the muscles of the abdomen, passes on the colon, around which it forms the lumbar mesocolon in front of the kidneys, from which it is separated by cellular tissue ; it then passes on each side towards the vertebral column, covering the ureters, spermatic and renal vessels, vena cava, and aorta, and reflecting itself from behind forward ; the folds from the right and left sides being here in apposition, form the mesentery, which is fixed by its narrow border to the vertebral column, and by its great one to the whole length of the small intestines ; between its folds the lymphatics, blood-vessels, ganglia, and nerves are situated.

2d, *Hypogastric portion*.—It descends on the median line, on the urachus and umbilical arteries, forming three folds ; it then covers the posterior surface of the recti abdominis muscles, and lower down the summit and posterior region of the bladder ; afterward, in man, the base of the vesiculæ seminales and rectum, forming the posterior ligaments of the bladder ; and behind the rectum the fold termed the meso-rectum ; in woman it passes from the bladder on the vagina, and from this to the uterus, covering its anterior and posterior surfaces and superior border, and forms on each side the broad ligaments ; it then ascends, in both sexes, in front of the articulation of the sacrum with the vertebræ, to be continuous with the umbilical portion. On the sides of the median line it descends from the abdominal parietes into each iliac fossa, where it forms on the right side the meso-cæcum, and on the left the iliac mesocolon.

3d, *Epigastric portion*.—It differs in its arrangement on the right and left side and in the middle. On the left side it covers the inferior surface of the diaphragm, the posterior part of the splenic vessels, the

posterior half of the internal surface of the spleen, its external surface, its circumference, the anterior half of its internal surface, the anterior part of the splenic vessels, from whence it passes to the great end of the stomach, and becomes continuous with the anterior fold of the omentum. In the middle, it passes from the diaphragm on the anterior surface of the stomach, afterward in front of the gastro-epiploic vessels; it then descends as far as the inferior part of the abdomen, is reflected from below upward towards the convex border of the transverse arch of the colon, forming thus two of the folds of the omentum. After gaining the inferior surface of the colon, it passes backward towards the vertical column, to form the inferior fold of the transverse mesocolon. On the right side it is reflected from the diaphragm on the posterior border of the liver, forms the coronary ligament, covers its superior face, and gives origin to the suspensory ligament of the liver, which becomes continuous with that portion lining the umbilical vessels; more inferiorly, it covers on one side the concave surface of the gall-bladder, and forms on the right side the right lateral ligament; on the other side it covers the inferior surface of the middle lobe, forms near its posterior border the left triangular ligament, and, passing on the anterior surface of the stomach, it forms the anterior fold of the gastro-hepatic epiploon. Beneath the neck of the gall-bladder it dips into a triangular opening termed the foramen of Winslow, descends on the posterior surface of the stomach, afterward behind the gastro-epiploic vessels, and reaches the inferior part of the abdomen with the first fold of the omentum. It then mounts towards the convex border of the arch of the colon, covers its superior surface, forms the superior fold of the transverse mesocolon, and comes out by the foramen of Winslow, to be continuous with that portion which was traced from the under and back part of the liver.\*

\* A clear description of the disposition of the peritoneum is attended with many difficulties; a proper idea of it can only be ac-

## ORDER II.

## RESPIRATORY APPARATUS.

THE lungs are the only organs of respiration.

## OF THE LUNGS.

*General conformation.*—They are contained in the two cavities of the chest, are separated from one another by the mediastina and heart, and distinguished into right and left. *Volume.*—Exactly the same as the capacity of the thoracic cavities; the right lung is a little larger than the left. *Specific weight.*—Lighter than the other organs; their weight is in general to that of the body as 28 or 35 to 1; in the infant which has not breathed, the relation is variable from 65 or 70 to 1; the act of respiration augments then the weight of the lung. *Density.*—The lungs are soft, very flexible, elastic, and crepitating. *Figure.*—That of an irregular cone, flattened on the inner side, its base inferiorly, and apex superiorly. *External face.*—Smooth, moistened with a serous fluid, unattached, and continually in contact with the parietes of the thorax. The left lung presents a very deep fissure, directed obliquely downward from the posterior to the anterior border, and dividing the lung into two lobes, a supero-anterior the smaller, and an infero-posterior the larger. A similar fissure divides the right lung into two lobes; the superior lobe of which is again divided into two portions by a second fissure, directed obliquely downward and outward. *Internal face.*—Plane, or slightly concave, contiguous to the mediastinum anteriorly, and with the vertebral column

quired by a lateral representation of the various organs of the abdomen in their natural position, and tracing on this its various folds, according as they envelop the different organs. The student may consult with advantage Dr. Turner's Medico-Chirurgical Education, where he will find a lateral representation of the peritoneum, as also of the pleura.

posteriorly, receiving the insertion of the bronchi and pulmonary vessels. *Anterior border.*—Thin, more or less uneven, notched on the left side to receive the point of the heart. *Posterior border.*—Thick, vertical, lodged in the groove placed on the side of the vertebral column. *Base.*—Concave, resting on the superior surface of the diaphragm. *Summit.*—Narrow, rounded, situated on a level with the first rib, and rising considerably above it on the right side. *Organization.*—The tissue of the lungs appears formed of extremely small lobules, into which the last ramifications of the bronchial tubes, pulmonary artery, and veins pass. These lobules are united together by cellular tissue, form lobes more or less voluminous, the assemblage of which constitutes the mass of the lungs.

*The Pleuræ.*—These are two serous membranes, resembling a sac without an opening. *Course.*—They cover the inner face of the ribs, their cartilages, intercostal muscles, and the upper corresponding surface of the diaphragm; pass afterward on the lateral parts of the bodies of the vertebræ, approaching one another, and leaving between them a triangular space termed the posterior mediastinum, in which the aorta, œsophagus, vena azygos, thoracic canal, inferior part of the trachea, the origin of the bronchial tubes, and a great number of lymphatic ganglia, are lodged. Continuing on, they cover the sides of the pericardium in a small extent, and pass on the posterior part of the pulmonary vessels and lungs, then successively cover the posterior border of these organs, the convex surface, the anterior border, the smooth surface, and the anterior part of the pulmonary vessels; they cover afterward the remainder of the sides of the pericardium, in front of which they approach one another, and remove again from the posterior surface of the sternum, intercepting a space resembling the letter X, termed the anterior mediastinum, and lodging superiorly the thymus gland, and filled inferiorly with cellular tissue, which forms a communication with that of the abdomen, across a separation of the fibres



of the diaphragm, on the sides of the ensiform cartilage. *External surface of the pleuræ.*—It adheres firmly to the parietes of the thorax, and much more intimately to the surface of the lungs. *Internal surface.*—It is smooth, polished, and constantly moistened by serum, unattached, and contiguous to itself.

#### OF THE TRACHEA AND BRONCHIAL TUBES.

*Situation of the trachea.*—In front of the vertebral column, from the lower part of the larynx to a level with the second or third dorsal vertebra. *Figure.*—That of a cylindrical tube, flattened posteriorly, from eight to ten lines in diameter. *Relations.*—Anteriorly, and from above downward, with the thyroid gland, inferior thyroid veins, sterno-hyoid and sterno-thyroid muscles, thymus gland, left subclavian vein, arteria innominata, and arch of the aorta; posteriorly with the œsophagus, and a little on the right side with the bodies of a few of the vertebræ; laterally with the primitive carotids, internal jugular veins, par vagum, and branches of communication of the cervical ganglia. *Superior extremity.*—United by a fibrous substance to the inferior border of the cricoid cartilage. *Inferior extremity.*—It bifurcates, on a level with the second dorsal vertebra, into the right and left bronchus; the right is broader, shorter, more horizontal than the left, and anterior to it; it penetrates the lungs on a level with the fourth dorsal vertebra, embraced in its course by the curve of the vena azygos, and by the arch of the right pulmonary artery; the left is longer and more oblique than the right, and is embraced by the aorta and left branch of the pulmonary artery. *Organization.*—Its fibro-cartilaginous rings are from sixteen to twenty in number, elastic, incomplete posteriorly, and lying horizontal to one another; in the bronchial tubes these rings become thin and small, and at length disappear in the last ramifications. The *fibrous membrane* extends from the cricoid cartilage to the last divisions of the bronchi; posteriorly it is flattened, and forms the trachea; in



other parts of this canal it is interrupted by fibro-cartilaginous rings. *External surface.*—Studded posteriorly with small reddish mucous follicles, termed tracheal glands. *Inner face.*—Contiguous anteriorly with the mucous membrane of the trachea, and posteriorly with a layer of transverse muscular fibres attached to the extremities of the rings.

*Mucous membrane.*—Thin, reddish, folded longitudinally, continuous with that of the larynx, extending to the ends of the ramifications of the bronchi; in contact, on the outside, with the fibro-cartilaginous rings, and the fibrous membrane; perforated on the inside by the excretory orifices of its mucous follicles.

The vessels of the trachea come from the superior and inferior thyroid artery; its nerves from the pneumogastric. The arteries of the bronchi arise from the aorta, and its nerves from the pulmonary plexuses.

*Parenchyma of the lungs.*—The proper tissue of the lungs seems to be formed by extremely small lobules, to which come the final terminations of the bronchi, pulmonary artery, and veins. These lobes, united by cellular tissue, form lobes which gradually increase in size, and which form the mass of the lungs.

*Thymus gland. Situation.*—At the upper part of the anterior mediastinum. *Volume.*—In the fœtus, extending from the thyroid gland as far as the diaphragm, atrophied and very small in the adult. *Form.* Oblong, bilobed, glandular, flattened from before backward, bifurcated at its extremities. *Relations.*—Posteriorly with the trachea, inferior thyroid veins, left subclavian vein, superior vena cava, arch of the aorta, and pericardium; anteriorly with the sternum, and inferior part of the sterno-hyoid and sterno-thyroid muscles. *Structure.*—Yellowish white; covered by a cellular capsule, and divided into lobules or vesicles, filled with a milky fluid.

## ORDER III.

## CIRCULATORY SYSTEM.

It is composed of the heart and its envelope, of arteries, veins, and lymphatics.

## CIRCULATORY SYSTEM GENERALLY.

This is formed, 1. By a central organ, the active and essential agent of the circulation, that is, the heart. Its general anatomy may be found in the article on the muscular system of animal life. 2. By the vascular system, a series of membranous tubes termed vessels, which are united to each other in the form of a tree, and the functions of which are to contain the fluids designed for nutrition and for the secretions. *Divisions.*—Three orders of vessels compose the vascular system; of these, the two first, the *arteries* and *veins*, carry blood; the vessels of the third order are termed *lymphatics*, and contain the lymph and chyle, white fluids, the former of which is found in all the organs, while the latter, the product of digestion, is absorbed in the cavity of the intestines. *Form.*—The vascular system represents a continuous apparatus, termed the *circulatory*, because the fluids which pass through it form a kind of circle, returning in their course to the point from whence they proceeded.

The heart is the point where the great vascular trunks unite. The trunks, on leaving this organ, divide successively into branches, twigs, and ramuscles, which continually decrease, and form capillary vessels, which are extremely small, and are found in all the organs. After dividing a great number of times, these vessels communicate either by twigs proceeding from one to another, or by the opening of one into another. This union of two vessels is

termed anastomosis, and the object of it is to facilitate the circulation.

*Surfaces.*—The external surface of the vessels is united to the parts adjacent by cellular tissue. Their cavity is smooth, and in contact with the fluids which pass through them. *Structure.*—The parietes of the vessels are composed of several superimposed and cylindrical membranes, which vary in the different vessels. They receive bloodvessels and lymphatics, termed by anatomists *vasa vasorum*, and also nerves, which form a kind of network on their surface, and generally come from the trisplanchnic nerve.

*Arteries.*—The arteries are vessels which carry the blood from the heart to the organs. *General arrangement.*—The union of the arteries represents two trees, each having a special trunk, which leaves the ventricles of the heart, one general, carrying red blood, the other pulmonary, containing black blood. The arteries, after arising, divide and subdivide successively, and terminate in the capillary system, where they are continuous with the radicles of the veins. *Form.*—The form of the arteries is cylindrical; their diameter is less than that of the veins, and decreases as they go from the heart; they are less numerous also than the veins; and the course of the large trunks in the organs, and their tissue, is nearly straight; but their secondary branches and twigs are tortuous. The arteries anastomose with each other less frequently, however, than the other vessels. Their external surface is surrounded with a sheath, which is loosely united to them, and which is formed by the condensation of the surrounding cellular tissue. Their inner surface is smooth. At the origin of the two large arterial trunks it presents valves, which are the only ones in the arterial system. *Structure.*—The arteries are composed of three superimposed cylindrical membranes; the external, which is looser, more extensible, and more resisting than the others, is formed by the cellular tissue, and presents a more compact tissue at the part corresponding to the fibrous membrane; the middle, or

fibrous, is the special tunic of the arteries; it is yellow, very elastic, and analogous to the yellow ligaments of the vertebræ. It is composed of nearly circular, firm fibres, which are very elastic in their longitudinal direction, which corresponds to the circumference of the arteries. 3d, The inner, or common membrane, is whitish, transparent, thin, very fragile, without apparent fibres, smooth and polished on its inner face, and attached by the external to the fibrous tunic. It continues into the cavity of the heart, and is thicker in the arteries which carry red blood than in those which carry dark blood. At the entrance of the ventricles it forms three folds, termed the sigmoid or semilunar valves, the object of which is to oppose the return of the blood from the artery to the ventricle. *Vitality.*—The sensibility of the arteries is very slight; their contractility, which has been denied by many anatomists, is now generally admitted. It is evidenced by the pulsations of these vessels, a phenomenon resulting not only from the impulses of the heart, but from the expansion and contraction of their parietes. *Functions.*—The arteries carry blood to all parts of the body; this fluid is moved in these vessels by jets isochronous with the contractions of the heart.

*Capillary system.*—The capillaries are the result of the final ramifications of the arteries and of the first radicles of the veins. *Division.*—There are three capillary systems; 1st, The general capillary system, in which the vasa afferentia carry red blood, and the vasa efferentia black blood; 2d, The pulmonary capillary system, in which an opposite arrangement exists; 3d, The capillary system of the liver, which is entirely venous, and is composed of the last divisions of the vena portæ and of the first radicles of the supra-hepatic veins. *Situation and formation.*—The capillary vessels form a general network, distributed to all the organs, and all the parts of which communicate. Taken as a whole, they constitute the most extensive portion of the vascular system; but their quantity varies in the different organs. In

some organs they are very numerous; in others we find but few. The communication and continuity of the capillary vessels is proved by several facts, and among others by the fine microscopic observations of Leuwenhoeck on frogs, and also by the transition of injections from the arterics into the veins, and *vice versâ*. *Structure*.—The capillaries are so small that we cannot determine their organization. *Vitality*.—Their sensibility varies like that of the organs of which they make a part. Their contractility is very well marked. *Functions*.—The capillary system is filled with blood, which moves in every direction in the small canals, under the influence of their contractions, and under that of the pulsations of the heart. The pulmonary capillaries place the blood in relation with the atmospheric air, and are the seat of an aqueous exhalation, which constitutes pulmonary transpiration. The capillaries which result from the divisions of the aorta, depose in all the organs the materials necessary to their nutrition, but lose in some cases the fluids which ought to serve for the exhalations and secretions. Near their extremities the capillaries become venous and carry black blood, absorb the excrementitious products of certain functions, and the residua of nutrition. *Erectile tissue*.—This tissue, termed the *erectile* by Beclard and some others, is a variety of vascular tissue, remarkable for becoming turgid with blood when under the influence of excitement. This turgescence, termed erection, ceases with the cause that produced it. The erectile tissue composes the cavernous bodies of the penis and clitoris, the lips of the vulva, the nipple, the papillæ of the tongue, &c. The erectile tissue is formed by a very close interlacing of arterioles, and particularly by numerous veinules, which, by constantly communicating with each other, form a multitude of cellules filled with blood. This interlacing is supported by an elastic fibrous tissue. It receives a great number of nerves.

*Venous system*.—The veins are the vessels through which the blood passes to return from all parts of the

body to the auricles of the heart. *General formation.*—The veins represent three trees, two of which correspond to those which form the arterial system; the third is that of the vena portæ, the trunk of which is formed by the union of the veins of all the digestive organs and spleen, and ramifies like an artery in the tissue of the liver. The veins are generally nearer the surface of the body than the arteries. Many of the veins lie directly under the skin, which is not the case with the arteries. Their course is not tortuous like that of the arteries. These last vessels are always attended in their course with one or two vessels, and hence the veins are much more numerous than the arteries. The veins arise in the different organs by a great many radicles, and unite successively to form twigs, branches, and trunks. The tree they form is much larger in capacity than that of the arteries. *Anastomoses.*—The veins frequently communicate with each other; this is true even of their largest trunks, as the venæ cavæ, which communicate by means of the azygos vein. The sub-cutaneous veins anastomose so extensively, that they form a kind of network on the surface of the body. *Form.*—The veins are not so regularly cylindrical as the arteries. They present externally a knotted appearance, which knots correspond to internal folds, termed *valves*. *Structure.*—The veins are formed of three tunics, like the arteries. The external is less dense than that of the arteries, is cellular, and intimately united to the middle membrane. The middle tunic is very thin, of a loose texture, composed of longitudinal fibres, which are soft, reddish, and very extensible, and which seem to be of a muscular nature. The internal membrane or tunic is smooth, polished, more extensible and resisting than that of the arteries, and of a filamentous nature. It continues into the right cavities of the heart. It forms a great number of parabolic folds, termed *valvules*, the loose edge of which is directed towards the heart, and which are fitted to the parietes of the vein when the blood goes to the heart. If any cause opposes the

course of this fluid, the valves rise and prevent its retrograde motion. The veins receive vessels and nerves. *Vital properties and functions.*—The sensibility of the veins is slight; their contractility is particularly seen in the large trunks. The duty of the veins is to carry to the heart the blood which comes from all parts of the body. This progress is proved, 1st, By the swelling of the veins below the place where a ligature is applied to a limb, and by the collapse of the same veins between the ligature and the heart. 2d, By the direction of the valves. 3d, By microscopic observations. The causes of the course of the blood in the veins are, the contraction of the left ventricle, the proper action of the veins, the contractions of the muscles, the direction of the valves, and finally, according to Barry's experiments, a sucking up of blood into the right auricle, produced by the dilatation of this latter; Magendie, and the old physiologists, think that the veins absorb.

*Lymphatic system.*—This system is composed of two kinds of organs, the lymphatic vessels and ganglions. 1st, *Lymphatic vessels.*—The lymphatic vessels, so termed because they carry white fluids, arise by thin radicles either in the tissue of the organs or on the surface of the intestines, and unite to form several trunks, which enter the venous system.

*Form and situation.*—The general form of these vessels is that of a large network, composed of a multitude of lymphatics, which communicate by numerous ramifications, and which terminate in its two principal trunks. These vessels exist in all the organs except the brain, spinal marrow, eye, internal ear, and placenta. In each of the organs they form a superficial and deep-seated plane. They are much smaller than the veins, but are also much more numerous. *Origin, course, termination.*—The origin of these vessels has hitherto escaped observation. Many physiologists maintain that their radicles are continuous with the arterial capillaries, founded on the passage of the injections of the arteries into the lymphatic vessels. These radicles are extremely

numerous, and form, by their extensive anastomoses, a very compact network. The lymphatic vessels penetrate into the lymphatic ganglions, which are found in their course after they are surrounded by numerous ramifications, termed the *vasa afferentia*. They emerge from that extremity of the ganglion which looks to the thoracic duct, and are termed *vasa efferentia*. The lymphatic vessels open into two principal trunks; one, termed the thoracic canal, commences by an enlargement, named the *reservoir of Pecquet*, and terminates in the left subclavian vein; the other, termed the great right lymphatic vessel, enters the right lymphatic vein. According to Lippi's experiments, a great many lymphatic vessels open directly into the veins around them. *Structure*.—The lymphatic vessels are composed of two envelopes; an external, which is firm, filamentous, and uneven externally, and adherent to the surrounding parts; and an internal, which is thin and fragile, and which forms here and there folds, which are generally parabolic, and are termed valves. *Vital properties and functions*.—The lymphatic vessels are said to be contractile. In the healthy state they are insensible. Their functions are to absorb in all the organs, and on the surface of all the membranes, the substances which are to enter the blood, and to pour them out in the form of chyle and lymph, after passing a greater or less distance into the venous system.

*Lymphatic ganglions*.—The lymphatic ganglions are small, very consistent, of a varied colour, uneven, more or less ovoid, varying in size from the bigness of a bean to that of an almond, situated exclusively in the course of the lymphatic vessels. They are found principally in the neck, axillæ, groins, chest, abdomen, &c. They are composed by the interlacing of the *vasa afferentia*, of some sanguineous vessels, and of nervous filaments. They contain a matter analogous to the lymph, but more dense. They are imbedded in loose cellular tissue, which thickens on their surface, and forms for them a kind of membranous envelope. Their functions are unknown. It



is supposed that the chyle and lymph undergo in them a special elaboration.

## OF THE HEART AND PERICARDIUM.

### PERICARDIUM.

*Situation.*—At the lower part of the anterior mediastinum, above the central aponeurosis of the diaphragm, to which it is united. *Form.*—That of an irregular conoid sac, enveloping the heart and the commencement of the large vessels. *Relations.*—Anteriorly with the pleura, thymus gland, sternum, and cartilages of the last true ribs of the left side; posteriorly with the bronchial tubes, œsophagus, and descending aorta; laterally with the pleura, diaphragmatic nerves, and internal surface of the lungs; inferiorly with the phrenic centre of the diaphragm. *Organization.*—Formed of two membranes, the external fibrous, the internal serous. The fibrous membrane adheres intimately downward to the aponeurosis of the diaphragm; it embraces the heart to its base, and is continuous to a greater or less distance on the origin of the large vessels, forming around each of them a kind of sheath. The external surface is covered by the pleura, the internal is covered by the serous membrane. Its tissue is pearly, aponeurotic, analogous to that of the dura mater, but thinner. The serous membrane, like all membranes of the same order, represents a sac without an opening, which contains no organ in its cavity. It covers first, from below upward, the whole internal face of the fibrous membrane, comes to the base of the heart, where it is reflected on the aorta, the pulmonary artery, the superior vena cava, and the pulmonary veins; covers these vessels, penetrating a greater or less distance into their interstices, and then descends over the whole surface of the heart, which it covers. Its external surface adheres intimately to the fibrous membrane and to the heart. The internal surface is smooth and lubricated by serum. The arteries and veins of the pericardium are very small, and arise from those which go to the adjacent organs.

## HEART.

*Situation.*—In the cavity of the pericardium, having nearly the same relations as this latter. *Volume.*—In the adult, it equals nearly that of the hand when closed. *Form.*—That of an irregular cone, a little flattened from before backward; its base is turned upward, backward, and a little to the right side; the apex downward, forward, and a little to the left. The heart presents an external surface and four cavities. *External surface.*—The anterior face is convex, directed a little upward, traversed in the middle by an oblique groove, which passes downward and to the right side, and which lodges the anterior coronary artery and vein. The posterior face is flattened, nearly horizontal, turned downward, applied on the phrenic centre of the diaphragm, and presents a groove for the posterior coronary vessels. The *right border* is directed downward; it is thin, and lies on the diaphragm; it is longer than the left. The *left border* is turned backward and upward; it is rounded and thick. The *base* is separated from the vertebral column, on which it rests, by the aorta and œsophagus, and presents a groove indicating the union of the ventricles and auricles. The *apex* is lodged in the notch in the left lung, corresponding to the interval of the cartilages of the fifth and sixth ribs.

## CAVITIES OF THE HEART.

These cavities are four; the two superior, which are smaller, occupy the base of the organ, and are termed the *auricles*; the other two are larger and lower, and are termed *ventricles*. On each side are an auricle and ventricle.

**RIGHT AURICLE.** *Situation.*—At the antero-inferior part of the right side of the base of the heart, on the diaphragm. *Form.*—Elongated transversely, broader on the right side and posteriorly than on the left and anteriorly, presenting on this latter side a floating appendix, with denticulated borders, placed between the aorta and right ventricle. *Exterior surface.*—Free on

the outer side, continuous on the inner with the left auricle, inferiorly with the right ventricle, posteriorly with the two venæ cavæ. *Internal surface.*—It presents four sides. Its posterior side presents superiorly the orifice of the superior vena cava, looking obliquely forward and downward, and separated from the inferior vena cava by the tuberculum Loweri, a prominence formed by a portion of fat, or of a fleshy fasciculus. Inferiorly we observe the orifice of the inferior vena cava, directed upward and inward, presenting a membranous fold termed the Eustachian valve. This valve is semilunar, and nearly vertical; its anterior surface looks towards the cavity of the auricle, its posterior towards that of the inferior vena cava; its left extremity is continuous with the anterior pillar of the fossa ovalis. Beneath this valve we observe the opening of the coronary veins, provided with a valve in the form of a crescent. *Anterior side.*—Superiorly we observe the small cavity of the auricular appendix, with its fleshy pillars; inferiorly, the right auriculo-ventricular opening, forming the communication between the right auricle and right ventricle. *External side.*—It presents nothing but the muscular fasciculi, which leave spaces between them. *Internal side.*—This is formed by the septum of the auricles, and presents inferiorly the fossa ovalis, replaced in the fœtus by the foramen of Botal, which establishes at this age the communication between the auricles. The fossa ovalis is provided anteriorly with a sort of thick and semilunar valve, which corresponds on the inner side to a similar valve of the left auricle. The cavity of the right auricle presents the orifices of several veins of the heart.

**LEFT AURICLE.** *Situation.*—At the supero-posterior part of the left side of the heart. *Form.*—Resembling a cube; presenting at its supero-internal part an auricular appendix similar to that of the right side. *Relations.*—Posteriorly with the vertebral column; anteriorly with the rest of the heart. *Internal surface.*—The anterior side presents the cavity of the auricular appendix, and the left auriculo-ventricular open-

ing. The *posterior side* receives superiorly the right pulmonary veins. The *internal side* is formed by the septum of the auricles, presenting a semilunar valve, the concave border of which is directed forward and to the left side. The *external side* presents the orifices of the two left pulmonary veins.

**RIGHT VENTRICLE.** *Situation.*—At the anterior part of the right side of the left ventricle. *Form.*—That of a triangular pyramid, the base of which is superiorly and posteriorly. *Cavity.*—We observe a great number of fleshy columns, termed the *carncæ columnæ*, which may be divided into three species; those of the first kind are from four to nine in number, more voluminous than the others, and directed from the point of the heart towards its base; fixed by one of their extremities to the parietes of the ventricle, and by the other to the tricuspid valve, by a small tendon. Those of the second kind are free in their circumference, and united by both their extremities to the parietes of the heart; lastly, those of the third kind are very numerous, adhere to the parietes of the heart by one side, and are free in the rest of their circumference. *Base.*—This presents two openings; the one, situated posteriorly, leading into the right auricle, and termed the right auriculo-ventricular orifice, is provided with a tricuspid valve, one of the surfaces of which is turned towards the parietes of the ventricle, the other towards the cavity of the auricle; one of its borders adheres to the circumference of the orifice, the other is irregular, floats, and is held in situ by the tendons of the *carncæ columnæ*. The other, opening at the base of the ventricle, is situated in front of the preceding, and termed the pulmonary artery, the orifice of which is provided with three membranous folds, termed *sigmoid valves*, of a crescent form, adherent to the artery by their convex and inferior border, and presenting in the middle of their free margin a small tubercle termed the *corpus aurantii*.

**LEFT VENTRICLE.** *Situation.*—At the posterior part of the left side of the heart. *Volume.*—Narrower and longer than the right. *Form.*—That of a cone flat-

tened a little on the right side. *Cavity*.—It presents the carneæ columnæ similar to those of the right side; the base of the ventricle is pierced by two orifices; one posterior, communicating with the auricle, and termed the left auriculo-ventricular orifice; it is surrounded by a whitish circle, and is provided with a fold, termed the mitral valve, because its free border is divided into two tongues, to which the tendons of the carneæ columnæ are attached; the other opening, on the right of this latter, leads into the aorta, and is provided with three sigmoid valves.

ORGANIZATION OF THE HEART.—The proper tissue of this organ is formed of fleshy fibres, in close apposition with one another, taking a spiral course from the base to the apex, and there dipping in and forming the carneæ columnæ. The parietes of the auricles are much thicker than those of the ventricles. In the right auricle there is a thick layer of longitudinal fibres at the union of the venæ cavæ: in every other part the muscular tissue forms only thin fasciculi, between which the parietes of the auricle are membranous. The parietes of the left auricle and left ventricle are considerably thicker than those of the right. In the septum, the fleshy fibres of one ventricle interlace with those of the other, and they may be separated. The membrane of the right cavities of the heart is continuous with the internal tunic of the veins; it lines the right auricle, forming the Eustachian and coronary valves, passes into the right auriculo-ventricular opening, forming the tricuspid valve; it afterward enters the pulmonary artery, the ramifications of which it follows. The membrane of the left side is continuous with the internal tunic of the arteries; it commences in the pulmonary veins, lines the auricle, passes into the ventricle by the left auriculo-ventricular opening, forms the mitral valve, and passes into the aorta. The arteries come from the aorta; its veins empty into the right auricle; its nerves arise from the cardiac plexus.

## ANGIOLOGY.

THIS part of anatomy comprehends the arteries veins, and lymphatics.

## SECTION I.

## ARTERIES.

[The arteries can only be well studied by injecting them; the mode generally pursued for doing this is the following: make two longitudinal incisions along the lateral edges of the sternum, so as to cut the costal cartilages from the 2d to the 6th; we then, with a mallet and chisel, cut transversely the part of the sternum between these cartilages. This fragment of bone being removed, we open the pericardium, separate the pulmonary artery from the aorta, and make in this last vessel a longitudinal incision, through which we introduce the tube of a syringe, and then tie the tube and the vessel. The fluid most generally introduced into vessels is composed as follows: tallow two pounds, Burgundy pitch half a pound, essence of turpentine four ounces, lampblack two ounces; boil the materials together, and strain through a picce of linen; then boil the fluid again, and inject. The following is a useful hot injection: wax one pound, rosin and turpentine varnish of each half a pound, vermilion one ounce. This is a handsome injection, but in warm weather it is liable to melt. A cheaper and better injection is the following: tallow two pounds, magnesia usta half an ounce, vermilion one ounce. To see the minute arteries, the cold paint injection will be found useful. It is made by taking white lead well ground two pounds, turpentine varnish twelve ounces, drying oil six ounces. The lead is intimately mixed with the varnish, and then the oil is added; they are then mixed up to the consistence of cream, and thrown into the vessels.]

## TABLE OF THE ARTERIES.

## 1. PULMONARY ARTERY.

[*Preparation.*—Remove the anterior wall of the chest, cut the pericardium, and expose the vena cava, the aorta, and pulmonary artery.]

*Origin.*—From the supero-anterior part of the left side of the right ventricle ; it is provided near its orifice with three sigmoid valves, of a crescent form, adhering to the artery by their convex border, their concave being free, presenting in their middle the corpora aurantia. *Course.*—It passes obliquely upward and to the left side, crossing the track of the aorta, beneath which it passes. *Divisions.*—After a course of about two inches, it divides near the second dorsal vertebra into two branches, between which we observe a rounded ligament, the remains of the ductus arteriosus of the fœtus, passing to the concave part of the arch of the aorta. 1. The right pulmonary branch is longer than the left, passes transversely behind the aorta and superior vena cava, forms an arch in front of the corresponding bronchus, and is directed towards the internal surface of the right lung, where it divides into three branches. 2. The left pulmonary branch passes obliquely in front of the aorta and beneath its arch, embraces the bronchus of this side, gains the left lung, and divides into two branches. In the lungs, the branches of the pulmonary artery divide into innumerable ramifications, which accompany the pulmonary veins and bronchial tubes.

## 2. AORTA.

Common trunk of all the arteries of the body ; divided into five portions.

## 1. ARTERIES FURNISHED BY THE AORTA AT ITS ORIGIN.

Anterior and posterior cardiac.

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## 2. ARTERIES FURNISHED BY THE ARCH OF THE AORTA.

The arch of the aorta gives off, on the left, two large trunks: the primitive carotid artery, and the subclavian artery; and on the right, one trunk, which is larger, termed the brachio-cephalic: this divides into the primitive carotid and subclavian artery.

- |                                |  |
|--------------------------------|--|
| A. Primitive carotid.          | { Divided into the external and internal carotid.<br>{ Furnishes, 1st, Superior thyroid; 2d, Lingual, which gives the dorsal and sublingual; 3d, Facial, or external maxillary, which furnishes the inferior palatine, sub-mental, superior and inferior coronary; 4th, The occipital, which gives the posterior mastoid; 5th, The posterior auricular, which furnishes the stylo-mastoid; 6th, The inferior pharyngeal. The external carotid terminates by dividing into the temporal and internal maxillary.<br>{ It gives off the transverse artery of the face, the anterior auricular, and middle temporal.<br>{ Furnishes thirteen branches: Middle meningeal, inferior dental, deep posterior, temporal, the masseteric, pterygoidean, buccal, anterior deep temporal, alveolar, infra-orbital, vidian, superior pharyngeal, superior palatine, spheno-palatine.<br>{ It furnishes, 1st, The ophthalmic, which gives the lachrymal, central artery of the retina, supra-orbital, posterior ciliary, long ciliary, superior and inferior muscular, posterior and anterior ethmoidal, superior and inferior palpebral, nasal, and frontal; 2d, The communicating artery of Willis; 3d, Choroidean artery; 4th, Anterior cerebral; 5th, Middle cerebral.<br>{ Furnishes, 1st, The vertebral, which gives the anterior and posterior spinal, and inferior cerebellic; and forms, in uniting with that of the opposite side, the basilar, divided into the superior cerebellic and posterior cerebral; 2d, Inferior thyroid, which gives the ascending cervical; 3d, Internal mammary, which gives the anterior mediastinal and superior diaphragmatic; 4th, Superior intercostal; |
| External carotid.              |  |
| 1st, Temporal artery.          |  |
| 2d, Internal maxillary artery. |  |
| Internal carotid.              |  |
| B. Subclavian artery.          | {  |



- B. Subclavian artery.** { 5th, Transverse cervical ; 6th, Superior scapular ; 7th, Deep cervical. Continuing its course, the subclavian takes the name of axillary.
- Axillary artery.** { Furnishes, 1st, Acromial ; 2d, Superior thoracic ; 3d, Inferior thoracic, or external mammary ; 4th, Inferior scapular ; 5th, Posterior circumflex ; 6th, Anterior circumflex. In continuing, it takes the name of brachial.
- Brachial artery.** { Furnishes, 1st, Deep humeral, or external collateral ; 2d, Internal collateral. It divides afterward into the radial and ulnar.
- 1st, Radial artery.** { It furnishes the radial recurrent, dorsal artery of the carpus, dorsal of the metacarpus, and dorsal artery of the thumb ; and terminates in forming the deep palmar arch.
- 2d, Ulnar artery.** { Furnishes the anterior and posterior ulnar recurrent ; anterior and posterior interosseous, which furnishes the posterior radial recurrent. It terminates in forming the superficial palmar arch, which gives the collateral arteries of the fingers.

### 3. ARTERIES FURNISHED BY THE AORTA IN THE THORAX.

- These arteries are, { 1st, The right and left bronchial ; 2d, Œsophagean (4, 5, or 6 in number) ; 3d, Posterior mediastinal ; 4th, Inferior intercostals (8, 9, or ten in number).

### 4. ARTERIES FURNISHED BY THE AORTA IN THE ABDOMEN.

- These branches are, 1st, { The inferior right and left diaphragmatic arteries.
- 2d, Cœliac artery. { Divided into three branches ; 1st, Coronary of the stomach ; 2d, Hepatic, which gives the pyloric, the gastro-epiploica dextra, and the cystic ; 3d, Splenic, which gives the gastro-epiploica sinistra and the vasa brevia.
- 3d, Superior mesenteric artery. { Furnishes from its concavity the superior, middle, and inferior right colic ; and from the convexity fifteen to twenty intestinal branches.
- 4th, Inferior mesenteric artery. { Gives off the superior, middle, and inferior left colic ; and divides into the superior hæmorrhoidal.

5th, The middle capsular arteries (two on each side); 6th, Renal, or emulgent; 7th, Spermatic; 8th, Lumbar (four or five on either side).

# 5. ARTERIES RESULTING FROM THE BIFURCATION OF THE AORTA.

The aorta furnishes, a little before its bifurcation, the *middle sacral*, and divides into the *primitive iliacs*, which are divided into the internal and external.

A. Internal iliac artery.	{	Furnishes, 1st, The ilio-lumbar; 2d, Lateral sacral; 3d, Glutæal; 4th, Umbilical; 5th, Vesical; 6th, Obturator; 7th, Middle hæmorrhoidal; 8th, Uterine; 9th, Vaginal; 10th, Ischiatic; 11th, Internal pudic, which gives the inferior hæmorrhoidal, artery of the septum scroti, transversus perinæi, artery of the corpus cavernosum, and dorsalis penis.
B. External iliac artery.	{	Furnishes the epigastric, circumflex ilii, and continues afterward under the name of the crural.
Crural artery.	{	Furnishes, 1st, External epigastric; 2d, External superficial and deep-seated pudics; 3d, Profunda, which gives the external and internal circumflex, and the superior, middle, and inferior perforating arteries. In continuing its course it takes the name of popliteal.
Popliteal artery.	{	Furnishes the superior, middle, external, and internal articular arteries; and the inferior internal and external ones; the anterior tibial, which furnishes the tarsal and metatarsal arteries. The popliteal is divided into the posterior peroneal and tibial.
1st, Peroneal artery.	{	Divided into the anterior and posterior peroneal.
2d, Posterior tibial artery.	{	Divided into the internal and external plantar. It forms, in anastomosing with the continuation of the anterior tibial, the plantar arch, from which arise the superior or posterior perforating arteries, and the posterior, inferior, and anterior branches, which give off the anterior perforating arteries.

## OF THE AORTA.

*Origin.*—Seems to arise from the base of the heart, but is only attached to it by the internal membrane of the left ventricle, which forms, at its commencement, three sigmoid valves. Its proper tunic is not continuous with the fleshy fibres of the heart, but terminates in three semicircular portions, which correspond to each of the sigmoid valves, leaving between them and its fleshy fibres of the heart an interval of about two or three lines. It extends from the heart to the 4th or 5th lumbar vertebra. *Course.*—At its commencement it is covered by the pulmonary artery, passes upward and to the right, turns from right to left and from before backward, as far as the upper part of the second dorsal vertebra, and forms an arch, which terminates on the left side of the body of the third vertebra. More inferiorly, it descends on the interior part of the left side of the bodies of the other dorsal vertebræ, passes between the pillars of the diaphragm, continues downward on the lumbar vertebræ as far as the union of the fourth and fifth, where it terminates in dividing into two large trunks, termed the primitive iliacs. *Relations.*—In the interior of the pericardium, it is embraced posteriorly and on the left side by the pulmonary artery and its right branch; on the right side it corresponds to the superior vena cava and lung; anteriorly, the mediastinum separates it from the sternum. Its arch lies at first on the trachea, a little before the division of this latter, and afterward on the body of the second and third vertebræ. In the posterior mediastinum it lies on the left of the vertebral column, of the œsophagus, thoracic duct, and vena azygos. *Branches.*—The aorta is the common trunk of all the arteries of the body; it gives off branches at its origin, its arch, in the chest under the arch, in the abdomen, and at its bifurcation.

## 1. ARTERIES FURNISHED BY THE AORTA AT ITS ORIGIN.

*Right coronary artery.*—Arising from the aorta, a little above the free border of one of the sigmoid valves; it passes from within outward, turns on the base of the heart, and gains the groove observed on its posterior surface, where it divides into two branches; one passes to its apex, the other to its thick border. It furnishes many branches, distributed to the aorta, right auricle, and to the origin of the pulmonary artery. Farther on, it gives six or eight branches to the venæ cavæ, to the inter-auricular septum, and to the anterior and posterior sides of the right ventricle and auricle; one of them anastomoses at the summit of the heart with the left coronary. The branch which follows the posterior face of this organ is distributed to the corresponding wall of the two ventricles, and to the septum between them, and anastomoses with the left coronary artery; the other branch goes to the left auricle and ventricle.

*Left coronary artery.*—It has the same origin as the preceding, passes downward to the left and a little forward, and gains the groove at the anterior surface of the heart; distributes similar branches as the preceding, and anastomoses with it.

## ARTERIES FURNISHED BY THE ARCH OF THE AORTA.

This part of the aorta sends off three considerable trunks; on the right side, the *arteria innominata*; on the left, the *primitive carotid* and *subclavian*.

*Arteria innominata.*—Passes upward and to the right on the side of the trachea, and, after a distance of about an inch, divides into two large branches, the primitive carotid of the right side and subclavian.

*Primitive carotids.*—Their origin has been already mentioned; they mount a little obliquely outward on each side of the neck, as far as the superior part of the larynx, where they divide into the internal and external. *Relations.*—Inferiorly the right is a little anterior to the left; the interval of these arteries is oc-

cupied by the trachea and œsophagus, and superiorly by the larynx ; anteriorly the left carotid is covered in its inferior portion by the left subclavian vein, thymus gland, and clavicle ; both are in relation, anteriorly, with the sterno-mastoideus, sterno-hyoideus, thyro-hyoideus, and omo-hyoideus, by which they are separated from the platysma myoideus, but by which latter they are covered superiorly ; posteriorly with the inferior thyroid arteries, longus colli, and recti capitis muscles, and vertebral column ; on the inner side with the trachea, thyroid gland ; that on the left side is in relation with the œsophagus ; on the outer side with the internal jugular veins, par vagum, and sympathetic nerves.

**EXTERNAL CAROTID.** *Situation.*—At the supero-lateral parts of the neck ; extending from the superior part of the larynx as far as the neck of the condyle of the lower jaw. *Relations.*—1st, On the outer side, inferiorly with the platysma myoides and skin ; afterward with the hypo-glossal nerve, digastricus, and stylo-hyoid muscles ; and, in fine, with the parotid gland ; 2d, On the inner side, and from below upward, with the internal carotid, stylo-pharyngeus, and styloglossus muscles, and styloid process of the temporal bone. *Branches.*—1st, Anteriorly, the *superior thyroid, facial, lingual* ; 2d, Posteriorly, the *occipital and auricular* ; 3d, On the inner side, the *inferior pharyngeal*. *Termination.*—In the *temporal and internal maxillary*.

#### 1st. ANTERIOR BRANCHES OF THE EXTERNAL CAROTID.

**SUPERIOR THYROID.** *Situation.*—At the antero-superior part of the neck ; extending from the external carotid to the larynx and thyroid gland. It arises from the anterior part of the external carotid, and descends from behind forward and from without inward. *Relations.*—On the outer side with the platysma-myoides, omo-hyoideus, and sterno-thyroideus. *Branches.*—The *laryngeal*, which passes, with the nerve of the same name, between the os hyoides and thyroid cartilage into the larynx, across the thy-

ro-hyoid membrane, and is distributed to the muscles of this organ, mucous membrane, and epiglottis. The *crico-thyroid branch*, passing on the membrane of the same name. *Termination*.—At the thyroid gland, where it divides into three branches for this organ, and which anastomose with the thyroid artery of the opposite side, and the inferior thyroid of the same side.

#### EXTERNAL MAXILLARY.

[*Preparation*.—Place a block under the posterior part of the neck, and carry the head to the side opposite that to be examined. Dissect, and divide near their upper attachments, the digastricus and stylo-hyoideus muscles; depress them on the os hyoides, then turn the superficial part of the submaxillary gland on the lower part of the mylo-hyoideus.]

Arising from the anterior part of the external carotid, above the lingual. *Course*.—It passes transversely forward and inward, gains the internal part of the angle of the inferior maxilla, passes between the submaxillary gland and base of this latter bone, and mounts towards the commissure of the lips, on the side of the nose, and terminates in anastomosing with the nasal branch of the ophthalmic artery. *Branches*.—Beneath the inferior maxilla, 1st, The *inferior palatine*, applied against the superior lateral part of the pharynx after arising near the origin of the external maxillary; passes between the pillars of the velum palati, and supplies this part, the pharynx, tonsils, and Eustachian tube; anastomosing with the superior palatine artery. 2d, *Sub-mental branch*.—This passes forward, in apposition with the attachment of the mylo-hyoideus, along the inner face of the jaw; supplies the mylo-hyoideus and the digastricus, and divides into two branches, one of which unites to that of the opposite side, and the other ramifies below the chin, and anastomoses with the twigs of the inferior dental artery. The facial artery also gives off, below the jaw, many small twigs to the muscles of the superior hyoid region, sub-maxillary gland, internal pterygoid muscle, and mucous mem-

brane of the mouth. On the face it furnishes external branches, which ramify in the masseter, buccinator, and platysma muscles, &c., and internal branches, which go to the quadratus menti and levator anguli oris, and anastomose with the sub-mental and inferior dental artery. 3d, *Coronary arteries of the lips*.—They run in a serpentine manner in the free border of the lips, send twigs to the adjacent muscles, and anastomose with one another at the commissures. 4th, *Dorsal artery of the nose*.—This frequently terminates the external maxillary; it supplies the muscles of this part. 5th, *The superior muscular branches*.—They are variable, and are distributed in the muscles of the upper maxillary region and the integuments, and communicate with the sub-orbital and ophthalmic artery.

#### LINGUAL ARTERY.

[*Preparation*.—Dissect the facial artery, cut the mylo-hyoideus muscle near its lower attachment, and turn it over on the superior maxillary bone. Then follow the inferior maxillary bone to its centre, draw the tongue out of the mouth, and dissect the artery, separating the fibres of the muscles from the base of the tongue.]

This artery extends from the external carotid artery to the tongue, and to the muscles of the superior hyoid region. It arises from the anterior part of the external carotid, between the two preceding; passes inward, forward, and a little upward, gains the base of the tongue between the hyo-glossus and genio-glossus, and proceeds horizontally along its base, under the name of the *ranine artery*. *Branches*.—Beneath the hyo-glossus muscle, it sends branches to the middle constrictor of the pharynx, thyro-hyoideus, and digastricus; the *dorsal artery of the tongue*, ramifying in the stylo-glossus, back of the tongue, tonsils, and velum palati; on the genio-glossus muscle, the *sub-lingual*, sometimes coming from the sub-mental, passing horizontally forward, and above the sub-lingual gland, supplying this organ, the muscles of the tongue, and superior hyoidean region. Be-



neath the tongue the lingual furnishes many branches, which ramify in the substance of this organ, and in its mucous membrane.

## 2. POSTERIOR BRANCHES OF THE EXTERNAL CAROTID.

### OCCIPITAL ARTERY.

[*Preparation.*—Divide the mastoid process, and turn it over on the upper and back part of the neck, and also the muscles which are inserted in it. We also detach and turn downward and forward the styloid process, with the muscles to which it is attached. After finding the origin of the artery, we can trace its branches.]

This artery extends from the external carotid to the occipital. It arises from the posterior part of the carotid, passes obliquely backward, beneath the posterior belly of the digastricus, then curves backward, passes between the transverse process of the atlas and mastoid process, and lastly, goes to the occiput, at the superior part of which it terminates, becoming sub-cutaneous. It gives off superior branches, which go to the digastricus, sterno-mastoideus, and stylo-hyoideus, and one of which, the *posterior mastoid artery*, traverses the mastoid foramen, and ramifies on the dura mater. It then gives off inferior branches to the sterno-mastoideus, splenius, and complexus minor muscles. The sub-cutaneous branch gives off lower branches to the muscles on the back part of the neck, and upper branches which go to the integuments of the skull.

### POSTERIOR AURICULAR ARTERY.

[*Preparation.*—Only one branch of this artery, the *stylo-mastoid*, requires preparation; this may be followed into the internal ear by means of a gouge and mallet. But this preparation must not be made till the arteries of the head are dissected.]

This artery extends from the external carotid to the inner face of the pavilion of the ear, on the side of the head. It arises from the posterior part of the external carotid, in the thickness of the parotid gland, passes backward between the auditory foramen and



mastoid process, and, gaining the inferior part of the pavilion of the ear, divides into two branches, which supply the temporal muscles, the posterior auricular, and the integuments. Before bifurcating, it gives off a stylo-mastoid branch, which enters the foramen of the same name, passes through the aqueduct of Fallopius, and supplies the mucous membrane of the tympanum and the semicircular canals, &c.

### 3. INTERNAL BRANCH OF THE EXTERNAL CAROTID.

#### INFERIOR PHARYNGEAL ARTERY.

[*Preparation.*—When the internal maxillary, the cerebral, and the occipital arteries have been dissected, we see the pharyngeal artery between the external and internal carotid. To see the twigs sent to the dura mater and Eustachian tube, we must divide the head and the pharynx from before backward.]

It arises from the inner part of the external carotid artery, and passes vertically along the postero-lateral part of the pharynx, between the external and internal carotids, and divides into two branches; the *pharyngeal*, which is distributed to the constrictor muscles of the pharynx; and the *meningeal* branch, which passes between the internal carotid and internal jugular vein, and entering the foramen lacerum posterius, is distributed to the dura mater.

### 4. BRANCHES WHICH TERMINATE THE EXTERNAL CAROTID.

#### TEMPORAL ARTERY.

It commences on a level with the neck of the condyle of the inferior maxilla; passes a little obliquely outward, between the ramus of the lower jaw and external auditory foramen, beneath the parotid gland; it traverses the zygomatic arch and becomes cutaneous. *Branches.*—The temporal artery gives off, anteriorly, the *transverse artery of the face*, which passes from behind forward on the neck of the condyle of the inferior maxilla, and ramifies in the Stenonian duct and muscles about this region, anastomosing with the facial, buccal, and infra-orbital arteries. It gives off,

posteriorly, the *anterior auricular*, which supplies the pavilion of the ear, and internally, the *middle temporal artery*, which pierces the temporal aponeurosis near the zygomatic arch, and is lost in the temporal muscle; in the middle of the temple it divides into the anterior and posterior temporal arteries, which are distributed to the integuments and to the temporal aponeurosis.

#### INTERNAL MAXILLARY ARTERY.

[*Preparation.*—We begin by opening the skull and removing the brain; we saw the zygomatic arch at its two extremities, and turn it downward, together with the portion of masseter muscle attached to it; we then saw the jaw in three places, in front of the anterior edge of the masseter muscle, at the neck of the condyle, and at the coronoid process. This done, we draw the upper part of the ramus of the jaw gently outward, and turn it from before backward; after separating from it the internal pterygoid muscle, we raise the coronoid process. These preparations show the internal maxillary artery, situated between the external pterygoid muscle and the temporalis, and also the branches which it gives off there; we follow the twigs sent by the alveolar artery to the posterior teeth, removing with a scalpel the external plate of the maxillary bone. To see the sub-orbital branch, we must remove, with a mallet and chisel, all the outer portion of the orbit. To see the other branches, we must cut as for the corresponding branches of the fifth pair of nerves.]

This artery arises from the external carotid artery, at the same place as the temporal, passes from without inward and from above downward, and dips beneath the neck of the condyle of the inferior maxilla; it then ascends forward and inward, between the external pterygoid and temporal muscles, to gain the summit of the zygomatic fossa, from whence it penetrates into the sphenomaxillary fossa. In this course it gives off many branches.

#### BRANCHES OF THE INTERNAL MAXILLARY, BEHIND THE NECK OF THE CONDYLE OF THE INFERIOR MAXILLA.

1st, *Middle meningeal branch.*—It ascends nearly vertically between the two pterygoid muscles, and passes into the cranium by the foramen rotundum of

the sphenoid bone; it furnishes branches to the dura mater and fifth pair of nerves, to the aqueduct of Fallopius, anastomoses with the stylo-mastoid artery, and then divides into the anterior and posterior branches; the former ascend from behind forward, lodged in a deep groove in the inner face of the parietal bone, and supply the external surface of the dura mater; the latter are smaller, mount obliquely backward, and supply the corresponding part of the dura mater. 2d, *Inferior dental branch*.—It descends anteriorly along the inner face of the ramus of the inferior maxilla and outer side of the internal pterygoid muscle; enters the inferior dental canal, passes through it, and comes out by the mental foramen. Before entering the dental canal it supplies the internal pterygoid muscle, and inferior dental and lingual nerves. In the canal it supplies the teeth, its branches passing through the foramina at their roots. On a level with the mental foramen, it sends a branch to supply the depressor anguli oris and labii inferioris muscles, and sends others to the canine and incisor teeth.

#### BRANCHES OF THE INTERNAL MAXILLARY BETWEEN THE PTERYGOID MUSCLES.

1st, *Deep posterior temporal branch*.—It ascends first between the temporal and external pterygoid muscles, and afterward descends in the former of these muscles, and ramifies on its inner face and in the periosteum of the temporal fossa. 2d, *Masseteric branch*.—It passes from within outward, between the temporal muscle and neck of the condyle of the inferior maxilla, ramifies in the masseter muscle, and anastomoses with the transverse artery of the face. 3d, *Pterygoid branches*.—These vary as to their number and origin; they supply the pterygoid muscles, and particularly the external.

## BRANCHES OF THE INTERNAL MAXILLARY IN THE ZYGOMATIC FOSSA.

1st, *Buccal branch*.—Its origin varies; it descends from behind forward, between the internal pterygoid muscle and ramus of the inferior maxilla, advances towards the cheek, and ramifies in the buccinator and zygomaticus major muscles, and mucous membrane of the mouth. 2d, *Anterior deep temporal branch*.—It ascends into the anterior part of the temporal fossa, and is lost in the temporal muscle; some of its branches enter the orbit through the foramina of the malar bone. 3d, *Alveolar branch*.—It descends from behind forward on the maxillary tuberosity, sends branches into the superior and posterior dental canals for the molar teeth, other twigs go to the gums and buccinator muscle. 4th, *Infra-orbital branch*.—It arises from the internal maxillary at the supero-anterior part of the zygomatic fossa, and enters the infra-orbital canal, through which it passes, giving twigs to the adjacent parts. It sends a small twig into the anterior and superior dental foramen. On leaving this foramen it divides into many twigs for the roots of the canine and incisor teeth, which go to the adjacent regions, and anastomose with the alveolar, buccal, and ophthalmic arteries.

## BRANCHES OF THE INTERNAL MAXILLARY IN THE SPHENOMAXILLARY FOSSA.

1st, *Vidian branch*.—It is very small, and penetrates the pterygoid canal from before backward, and comes out to be distributed to the Eustachian tube. 2d, *Superior pharyngeal branch*.—It passes obliquely backward and upward, and entering the pterygo-palatine canal, goes backward, and terminates in the pharynx. 3d, *Superior palatine branch*.—It arises behind the summit of the orbit, and passes vertically into the pterygo-maxillary fissure, afterward into the posterior palatine canal, and passing out, is reflected forward to supply the mucous membrane of the palatine arch and its mucous follicles. 4th, *Spheno-pala-*

*tine branch.*—This may be considered as the termination of the internal maxillary artery. It passes into the nasal fossa by the sphenopalatine foramen, and soon divides into two branches, one of which goes on the septum, and the other on the outer wall. Each of its branches divides into a great number of branches, which are distributed to the pituitary membrane, and supply the nasal fossæ and the maxillary, sphenoidal, and frontal sinuses.

#### INTERNAL CAROTID ARTERY.

[*Preparation.*—The dissection of the internal carotid artery requires a lateral section of the skull, the same as for the internal maxillary artery. We have then only to open carefully the carotid canal: we then lay open the cavernous sinus by cutting the dura mater on the sides of the body of the sphenoid bone, being careful not to disturb the sixth pair of nerves.]

*Course.*—It separates from the external behind the digastricus muscle, ascends between the anterior lateral part of the vertebral column and the pharynx, approaches the skull, and enters its cavity through the carotid canal, following its turns. Coming out from this canal, it passes upward and forward, penetrates the cavernous sinus of the dura mater, which it traverses, making two inflections, and comes under the anterior clinoid process; here it curves vertically upward and a little backward, pierces the internal plate of the dura mater, mounts obliquely backward and outward, and terminates, on a level with the fissure of Sylvius, in very many branches. *Relations.*—1st, In the neck, on the outer side, with the internal jugular vein; on the inner, with the par vagum and sympathetic nerves; 2d, In the carotid canal, with a fold of the dura mater and ascending branches of the superior cervical ganglion; 3d, In the cavernous sinus, with the internal membrane of the sinus, and sixth pair of nerves, which lies on the outer side. The internal carotid artery furnishes a twig, which goes to the tympanum, and two or three others to the dura mater, to the pituitary body, and to the nerves of the third, fourth, fifth, and sixth pairs; at its termination,

it gives off posteriorly the communicating artery of Willis and the choroid artery; and anteriorly, the anterior and middle cerebral arteries. Before sending off these branches, it gives origin to the ophthalmic artery.

#### OPHTHALMIC ARTERY.

[*Preparation.*—First make in the orbit the section referred to for the internal maxillary artery: arrived at the trunk of the artery, by following the internal carotid artery to its origin, we dissect its branches by removing with the scalpel or scissors the fat which surrounds it; we preserve only the globe of the eye, the optic nerve, the muscles and arteries, carefully avoiding the smallest arterial twigs.]

The *ophthalmic artery* enters the orbit, traversing the optic foramen with the optic nerve, on the outer and under side of which it is situated; it passes on the external side of this nerve, afterward passes above it, crossing its direction from without inward, covered by the superior rectus muscle of the eye, and proceeds horizontally along the internal wall of the orbit, as far as the internal canthus, where it terminates in sending off, 1st, The *lachrymal artery*. This arises from the ophthalmic immediately after its entry into the orbit, passes outward between the external side of this cavity and external rectus muscle, as far as the lachrymal gland, where it ramifies. It gives some twigs to the rectus muscles, &c., and a small branch, which soon divides into two twigs, one of which passes to the periosteum of the orbits; the other goes to the temporal fossa, after passing through the malar bone. It gives twigs to the lachrymal gland, and sends off two branches to the upper and lower eyelids, and supplies the muscles in this region, as also the superior and inferior eyelid. 2d, *Central artery of the retina*.—It is very small, and pierces obliquely the coverings of the optic nerve, reaches its centre, and passes along into the eye, where it sends a great number of branches to the internal surface of the retina as far as the corpus ciliare; one of its branches penetrates posteriorly the vitreous humour. Above the optic nerve the oph-

thalmic sends off, 1st, The *supra-orbital branch*, which passes from behind forward along the superior wall of the orbit, above the recti muscles, and passes out of the superior orbital foramen, giving off in its passage a ramuscle to the diploe of the frontal bone. It then divides into an internal and an external branch, the former supplying the muscles in that region, the latter mounting on the forehead. 2d, *Posterior ciliary arteries*.—Very numerous, sometimes from thirty to forty; they anastomose around the optic nerve, and pass separately through the sclerotic coat, near the entry of this nerve; some are distributed to this membrane, but most of them divide, and pass between the sclerotic and choroid coats, and are distributed to the external face of this latter, forming a very delicate network. Most of these branches are lost in the ciliary processes; some of these form the great arterial circle of the iris. 3d, *Long ciliary arteries*.—Two in number; one on the inner side, the other on the outer; they traverse the sclerotica, pass horizontally forward between this coat and the choroid, and, reaching the ciliary circle, each divides into branches, which separate at an obtuse angle, and anastomose together, forming by their anastomoses a network on the great circumference of the iris. From the internal part of this arterial circle other small branches proceed, and form a second circle within the former; and again a third circle, which surrounds the pupil. 4th, *Superior and inferior muscular arteries*.—These are distributed to the superior and inferior muscles of the eye, to the periosteum, and lachrymal sac. The two muscular arteries, and sometimes the lachrymal and the sub-orbital, give rise to the anterior ciliary arteries, which are distributed in the conjunctiva, or perforate the sclerotic coat at the anterior point of the globe of the eye, and terminate in the great arterial circle of the iris.

The branches which arise from the ophthalmic, on the internal side of the optic nerve, are the *posterior* and *anterior ethmoidal arteries*, and the *superior* and *inferior palpebral*; the former are directed towards the



internal wall of the orbit, traverse the foramen orbitarium internum posterius, and are lost on the dura mater within the cranium; some of the branches go to the nasal fossæ. The latter supplies the anterior parts of the orbit, caruncula lachrymalis, lachrymal sac, eyelids, and tarsal cartilages, and anastomoses with branches of the lachrymal artery. The branches which terminate the ophthalmic artery are the *nasal* and *frontal*; the former passes to the root of the nose, and anastomoses with the terminating branch of the external maxillary artery; the latter passes out of the orbit superiorly, and ascends on the forehead, divides into two or three branches, which ramify in the adjacent muscles.

#### THE COMMUNICATING ARTERY OF WILLIS.

It arises from the internal carotid after the ophthalmic, passes backward and a little inward on the side of the pituitary gland and corpora mammillaria, and anastomoses with the posterior cerebral artery, a branch of the basilar. It gives branches to the optic beds and nerves, to the mammillary eminences, to the tuber cinereum, choroid plexuses, &c.

#### ARTERY OF THE CHOROID PLEXUS.

Arising above the preceding, it passes obliquely backward and outward, and near the crus cerebri penetrates into the lateral ventricle, to be distributed to the choroid plexus.

*Anterior cerebral artery.*—It passes obliquely forward and inward, under the anterior lobe of the brain, as far as the fissure of Sylvius; here it approaches that of the opposite side, and anastomoses with the communicating artery of Willis, and sends off branches to supply the fornix, anterior commissure, and septum lucidum. It is afterward directed forward, turns round the anterior extremity of the corpus callosum, and here takes the name of this part, at the posterior surface of which it terminates. In this course it gives off on the inside many ramuscles to the corpus



callosum, and on the outside, branches to the plane face of the cerebral hemispheres.

*Middle cerebral artery.*—It gives many twigs to the lower part of the brain and choroid plexus, passes outward and backward, dips into the fissure of Sylvius, where it divides into two branches, one for the anterior lobe, the other for the middle; both of which follow the anfractuositities of the brain, and ramify on the pia mater.

#### SUBCLAVIAN ARTERY.

[*Preparation.*—To show the subclavian artery, we first separate the pectoral muscles from their attachments to the sternum and ribs; then divide the intercostal spaces and the ribs, excepting the first, two inches behind the cartilages; then saw the sternum across directly below the insertion of the first rib; we can then easily remove the anterior wall of the thorax, which is detached from above downward; it will be well to divide the internal mammary artery only at the level of the second rib; this preparation shows the origin of the subclavian artery; we then divide the sterno-mastoideus, the sterno-hyoideus, and sterno-thyroideus at their inferior attachments, and turn them up; we remove the fat which surrounds the subclavian artery, which is then seen in its relations with the surrounding parts. These branches may be dissected by tracing them from their origin.]

*Situation.*—At the upper part of the chest and infero-lateral part of the neck; extending from the arch of the aorta to the upper face of the first rib, between the scaleni muscles; the right is larger and shorter than the left. *Relations.*—1st, Of the right; anteriorly, and from within outward, with the clavicle, sterno-hyoid, and sterno-thyroid muscles, right subclavian vein, par vagum, and phrenic nerves; posteriorly with the vertebral column and longus colli; on the outside with the summit of the pleura; on the inside with the primitive carotid. 2d, Of the left; anteriorly with the pleura, subclavian vein, par vagum, first rib, clavicle, and sterno-thyroid muscle; posteriorly with the vertebral column and longus colli; on the outer side with the pleura; on the inner with the primitive carotid. *Branches.*—Near the first rib, it sends off superior, inferior, and external branches, and beyond the scaleni muscles continues under the name of the *axillary*.

## VERTEBRAL ARTERY.

[*Preparation.*—Open the transverse processes of the cervical vertebræ, after removing the muscles which cover them; then open the vertebral column and the skull, being careful not to cut or tear the vertebral artery as it turns to enter the skull.]

*Extent.*—From the subclavian to the cerebrum, cerebellum, pons varolii, and spinal marrow. *Course.*—It arises deeply from the supero-posterior part of the subclavian, goes directly upward behind the inferior thyroid on the vertebral column, enters the foramen at the base of the transverse process of the seventh cervical vertebra, and mounts in the canal formed by the union of the foramina of the transverse processes of the other vertebræ of the same region. At the axis it leaves the canal, passes backward, upward, and outward, as far as the transverse process of the atlas, piercing its base from below upward, after having formed a curve; it then passes backward and inward, between this last vertebra and the occiput, describing a second curve, which is transverse and convex posteriorly. Lastly, it traverses the dura mater, enters the cranium by the occipital foramen, on the sides of the spinal marrow; then ascends inward and forward, between the corpora olivaria and pyramidalia, and unites with that of the opposite side to give origin to the basilar artery. *Branches.*—In its course along the neck the vertebral artery gives off several twigs, some of which go to the muscles of the neck, while the others pass through the foramina of conjugation into the vertebral canal, and ramify in the dura mater and medulla. At the upper part of the neck it gives off several branches to the muscles of the deep occipito-cervical region; one or two of these branches penetrate to the skull, and are distributed to the dura mater of the posterior fossæ of the base of this cavity. In the skull it gives off the anterior and posterior spinal, and inferior cerebellar arteries. *Posterior spinal.*—It arises near the corpora pyramidalia, passes downward and inward behind the spinal marrow, descending on its posterior sur-

face as far as the second lumbar vertebra. *Anterior spinal*.—It arises near the termination of the vertebral, and descends on the anterior surface of the spinal marrow; it unites, on a level with the occipital foramen, with that of the opposite side, to form a common trunk, which descends as far as the inferior extremity of the spinal marrow; gives off branches on each side, and anastomoses with the middle sacral. *Inferior cerebellic*.—It arises from the termination of the vertebral or from the basilar; passes outward, and advances in a serpentine manner on the inferior surface of the cerebellum; the first twigs are small, and go to the medulla oblongata, eighth and ninth pair of nerves, and pia mater of the fourth ventricle; the others divide on the surface of the cerebellum, and terminate in the pia mater.

#### BASILAR ARTERY.

It is formed by the anastomosing of the two vertebral arteries, commencing near the posterior border of the pons varolii; passes along the middle groove of its anterior face, and terminates in the space between the anterior prolongations, by dividing into two branches, the posterior cerebral arteries; in its course it gives off many small twigs to the fornix, cerebellum, olivary, and pyramidal eminences, &c.; on each side it furnishes a considerable branch, the *superior cerebellic*, which passes outward and backward, mounting on the superior surface of the cerebellum, where it spreads out into very many ramifications. The basilar also sends off the *posterior cerebral*; this is directed downward, and, arriving at the inferior part of the posterior lobe of the brain, it divides into numerous branches for the different parts in this region, and receives the communicating branch of Willis, which proceeds from the internal carotid; the branches of the posterior cerebral artery pass into the anfractuositities of the posterior lobe of the brain, and ramify in the pia mater.

## INFERIOR THYROID ARTERY.

It arises from the superior part of the subclavian; ascends vertically on the anterior scalenus as far as the fifth vertebra, where it turns inward to go to the thyroid gland, and sends off internal and external branches to the longus colli, œsophagus, trachea, and muscles in this region; also, the *ascending cervical artery*, which mounts on the anterior scalenus and longus colli as far as the rectus anticus major, supplying these muscles and the splenius. The inferior thyroid, at the infero-external part of the thyroid gland, divides into numerous branches, which supply this organ, and anastomose with those of the opposite side, and with those of the two superior thyroid arteries.

## INFERIOR BRANCHES OF THE SUBCLAVIAN.

## 1. INTERNAL MAMMARY.

[*Preparation.*—Separate from the sternum the cartilages of the ribs on one side only, saw the ribs of the opposite side near their centres, and turn the flap formed by the sternum and ribs towards the abdomen.]

It arises opposite the inferior thyroid artery, and passes inward and downward in front of the anterior scalenus; it enters the chest, descends along the posterior face of the sterno-costal cartilages, beneath the pleura, and divides into two branches near the ensiform cartilage. Near its origin it furnishes branches for the neighbouring muscles, and afterward sends off the *anterior mediastinal*, which descends in the superior separation of the anterior mediastinum, and divides into branches, which supply the thyroid gland, the thymus, and pleura, and cellular tissue of the mediastinum. More inferiorly it furnishes the *superior diaphragmatic*, accompanying the nerve of the same name, supplying the thymus gland and mediastinum; and at length loses itself in the diaphragm. It also gives off internal and external branches, which equal in number the intercostal

spaces; the external supply the intercostal muscles, the internal pass through them and supply the muscles of the thorax and of the abdomen. The last of these branches anastomoses with that of the opposite side on the xiphoid appendage, and terminates in the suspensory ligament of the liver. Of the two branches which terminate the internal mammary, the external goes to the transversalis and oblique muscles of the abdomen; the internal descends behind the rectus muscle, gives to it many branches, and anastomoses near the umbilicus with the epigastric artery.

*Superior intercostal artery.*—This arises from the postero-inferior part of the subclavian, descends under the pleura in front of the neck of the first and second ribs, where it generally terminates. In front of these bones it sends off a posterior and an external branch; the former is distributed to the muscles of the back; the latter supplies the intercostal muscles. In the second intercostal space it gives off two branches.

#### EXTERNAL BRANCHES OF THE SUBCLAVIAN.

##### 1. CERVICALIS TRANSVERSALIS.

It is directed outward, turns on the scaleni muscles above the nerves which form the brachial plexus; then descends, at first obliquely, under the trapezius and levator anguli scapulæ; afterward vertically, under the rhomboideus, along the posterior border of the scapula as far as its inferior angle, where it terminates. Near its origin it furnishes several twigs to the scaleni muscles, and a larger branch, termed the *cervicalis superficialis*, which supplies the trapezius, splenius, and skin of the lower and lateral parts of the neck. Near the superior angle of the scapula it divides into two branches, one of which goes outward under the scapula to the serratus major and subscapularis, while the other follows the posterior edge of the scapula, and is distributed to the serratus, rhomboideus, &c.

*Superior scapular artery.*—This arises often from the preceding, or from the inferior thyroid, takes a tortuous course from within outward, behind and beneath the clavicle, and comes to the upper edge of the scapula; it passes afterward above the coracoid ligament, sending some branches to the trapezius, and descends into the infra-spinatus fossa, supplying this muscle and the scapula.

*Cervicalis profunda.*—This artery arises from the posterior part of the subclavian, behind the anterior scalenus; it passes between the transverse processes of the last two vertebræ of the neck, and reaches the great complexus muscle, in which it is lost, as also in the other muscles of this region.

#### AXILLARY ARTERY.

[*Preparation.*—To see this artery and its branches, detach the upper edge of the pectoralis major from the clavicle, turn the two flaps of this muscle in contrary directions, after cutting it from above downward in its centre. Then divide the pectoralis minor below its upper third, and continue the preparation of the axillary artery below the tendons of the latissimus dorsi and pectoralis major muscle. We can easily dissect all the muscles of the upper extremity by following the axillary artery.]

This artery is the continuation of the subclavian.  
*Situation.*—At the superior lateral part of the thorax, and in the axilla. *Extent.*—From the first rib, in the interval of the two scaleni muscles, as far as the inferior border of the tendon of the latissimus dorsi. *Relations.*—1st, Anteriorly it is covered at first by the platysma myoides in a triangular space formed by the anterior scalenus, nerves of the brachial plexus, and the clavicle; afterward it is in relation with the clavicle itself, the direction of which it crosses, and with the subclavius muscle; more inferiorly with the pectoralis major and minor, and lower down with the tendon of the former, with the coraco-brachialis and biceps muscles. From the clavicle as far as the axilla, it is covered by the axillary vein. Posteriorly it is applied on the inner side against the brachial plexus; in the middle it corre-

sponds to the cellular interval which separates the serratus magnus and subscapularis; on the outer side it lies on the teres major and latissimus dorsi; inferiorly it is lodged in a groove on the superior surface of the first rib; afterward it corresponds with the first external intercostal muscle, the second rib, and the superior digitation of the serratus magnus, from which it is soon separated by the brachial plexus, or by cellular tissue and lymphatic ganglia. The brachial plexus is situated behind it as far as the inferior border of the subscapularis, where the principal branches of this plexus form a sort of sheath for the artery. Its branches are, 1st, *The Acromial*.—This arises from the anterior part of the axillary, and descends obliquely outward towards the deltoid muscle; and in the narrow space which separates this muscle from the pectoralis major, it divides into a superior and inferior branch; the former ramifies on the scapulo-humeral articulation; the latter follows the course of the cephalic vein, and is distributed to the deltoid and great pectoral muscles. 2d, *Superior thoracic*.—This arises generally with the former, descends obliquely forward between the pectoralis major and minor, to which it is distributed. 3d, *The external mammary, or thoracica longior*.—This arises a little lower down than the preceding; it descends from behind forward on the superior lateral part of the chest, along the inferior border of the pectoralis major, supplying this muscle, the integuments, and the mammæ. 4th, *Inferior scapular*.—Arising from the inferior part of the axillary, opposite the inferior border of the tendon of the subscapularis, it descends along the inferior border of this muscle, and gives off an inferior and superior branch; the former supplies the serratus magnus, latissimus dorsi, teres major, and skin; the latter is distributed to the various muscles of the scapula, and to the articulation of this bone with the humerus. 5th, *Posterior and anterior circumflex*.—The former arises from the posterior part of the axillary artery, passes horizontally backward, turns round the superior part of



the humerus, and is lost in the deltoid muscle; the latter is generally furnished by the preceding, passes horizontally forward and outward under the coracobrachialis and short head of the biceps, turns also round the humerus between this bone and the deltoid, in which latter muscle it is lost.

#### BRACHIAL ARTERY.

It is the continuation of the axillary artery. *Situation*.—At the anterior and internal part of the arm. *Direction*.—A little oblique from above downward, from within outward, and from behind forward. *Relations*.—1st, Anteriorly, and from above downward, with the coracobrachialis, brachial aponeurosis, and skin; and in the fold of the arm with the inferior aponeurosis of the biceps, and the median basilic vein; 2d, Posteriorly with the triceps and brachialis internus; 3d, On the inner side, with the brachial vein, median nerve, and skin; 4th, On the outer side, with the internal surface of the humerus, and internal border of the biceps. *Branches*.—It sends off numerous branches to the different muscles of the arm, and to the integuments and humerus. Two of these are larger, and are termed muscular branches. Beneath the articulation of the humerus with the ulna, it divides into the radial and ulnar. 1st, *External collateral artery*.—Its origin varies much; when furnished by the brachial artery, it comes off on a level with the groove of the humerus for the radial nerve, and descends from before backward between the three portions of the triceps, accompanied by the radial nerve, and divides near the posterior surface of the humerus into branches, which supply the triceps muscle near the olecranon, and the corresponding integuments. 2d, *Internal collateral artery*.—It arises from the internal side of the brachial, near the epitrochlea, passes inward in front of the brachialis internus, supplying this muscle, and dividing into branches for the olecranon and inferior part of the triceps.



## RADIAL ARTERY.

It is formed by the bifurcation of the brachial artery below the bend of the arm, and separates at an acute angle from the ulnar. *Situation*.—At the anterior external part of the fore-arm. *Extent*.—From the fold of the arm as far as the articulation of the carpus; here it turns outward, passes between the two first metacarpal bones, from thence into the palm of the hand, where it forms the deep palmar arch. *Relations*.—In the fore-arm, anteriorly with the radial vein and supinator radii longus; anteriorly and inferiorly with the skin alone; posteriorly with the anterior surface of the radius, from which it is separated from above downward by the supinator brevis, pronator teres, flexor pollicis longus, and pronator quadratus; on the inner side, and from above downward, with the pronator teres, palmaris, flexor superficialis; on the outer side with the supinator longus. It furnishes anterior and posterior branches, which ramify in the muscles of these regions and in the skin; and external branches, the most considerable of which is the *radial recurrent*. This passes outward and upward near the olecranon, forms a sort of arch, which gives off branches to the supinators and extensors; its internal branches ramify in the neighbouring muscles, anastomosing with a branch from the ulnar. At the wrist, the radial artery is covered by the abductors and extensors of the thumb, and lies on the superior part of the first metacarpal bone; it furnishes here external branches, and principally the *dorsal artery of the thumb*, which descends behind the first metacarpal bone and first phalanx of the thumb, and terminates in anastomosing with its external collateral branch. The third descends on the inner edge of the first metacarpal bone. The internal branches are two; one for the carpus, the other for the metacarpus. The *dorsal artery of the carpus*, which passes inward on the posterior face of the second range of carpal bones, terminates in anastomosing with a branch of

the ulnar, after giving off superior twigs, which are distributed on the radio-carpal articulation, and inferior twigs, which anastomose with the perforating arteries of the palmar arch, and are distributed to the interosseous muscles and the skin. The internal branch also gives off the *dorsal artery of the metacarpus*, which descends along the second metacarpal bone as far as the middle of the back of the hand, and is distributed to the indicator and to the integuments. In the palm of the hand, the radial artery divides into an external and internal branch, one of which goes to the inside of the thumb, the other to the inside of the index finger. The latter passes transversely on the inner side as far as the ring finger, forms the deep palmar arch, which is covered by the tendons of the flexor digitorum, and rests on the extremities of the metacarpal bones. The deep palmar arch gives off superior and very small twigs to the ligament of the carpus and muscles of the thumb; five inferior branches, which descend in the second, third, and fourth interosseous spaces, and divide near the metacarpo-phalangeal articulations into several ramuscles, which go to the fingers; anterior branches which go to the lumbricales muscles; posterior branches, three in number (a. perforantes), which pass through the interosseous muscles, and anastomose on the back of the hand with the dorsal artery of the carpus. The palmar arch terminates near the inner edge of the hand by anastomosing with a branch of the ulnar artery.

#### ULNAR ARTERY.

It is larger than the radial. *Situation*.—At the anterior-internal part of the fore-arm. *Extent*.—From the fold of the arm as far as the palm of the hand. *Course*.—It descends a little obliquely inward between the two layers of the anterior muscles of the fore-arm, at the middle part of which it comes from beneath these muscles at the place where the superficial flexor separates from the ulnaris internus; pre-

serving its direction as far as the os pisiforme; it curves outward, passes on the anterior annular ligament of the carpus, and forms the superficial palmar arch. *Relations*.—Anteriorly with the median nerve, afterward with the pronator teres, flexor superficialis, and ulnaris internus; inferiorly with the aponeurosis of the skin; posteriorly, and from above downward, with the brachialis internus, flexor profundus digitorum, and pronator quadratus, and with the annular ligament of the carpus; on the inner side with the ulnar nerve and tendon of the ulnaris internus; on the outer side with the superficial flexor of the fingers.

The ulnar artery furnishes, at its origin and from its inner side, the *anterior ulnar recurrent branch*, which descends outward on the brachialis internus, mounts towards the epitrochlea, where it anastomoses with the internal collateral artery, and gives off branches to the pronator teres, palmaris and flexor superficialis. In the fore-arm it sends off branches. The internal branches vary in number and arrangement. The largest is the posterior ulnar recurrent artery. It descends first on the inside before the deep flexor muscle of the fingers: it then ascends behind the epitrochlea, between this eminence and the olecranon process, communicates with the deep humeral and internal collateral artery, and distributes many twigs to the flexor digitorum communis, ulnaris internus, triceps brachii, and to the articulation of the elbow. The external branches are very numerous, and ramify in the superficial flexor and ulnaris internus. One of them anastomoses on the lower edge of the pronator quadratus with a branch of the radial. The anterior branches are very numerous, and are distributed to the muscles of the anterior and superficial region of the fore-arm. There is but one posterior branch. It is termed the interosseous artery. It arises from the posterior part of the ulnar artery, below the bicipital tuberosity, goes horizontally backward, and soon divides into two branches, an anterior and a posterior. The *anterior* descends in front of the interosseous lig-

ament, which it traverses, behind the pronator quadratus, and descends in the groove which lodges the tendons of the extensors of the fingers, as far as the carpus, where it anastomoses with the dorsal artery of this part. This artery gives off on each side a great many twigs to the great flexor muscle of the thumb, the deep flexor of the fingers, and the pronator quadratus. Some ramify in the posterior and deep muscles of the fore-arm, after passing through the interosseous ligament. The posterior interosseous artery, after traversing the interosseous ligament beneath the anconeus, sends off the *posterior radial recurrent*, which ascends towards the posterior part of the condyle of the humerus, and anastomoses with the external muscular branch of the brachial artery; it then descends between the supinator brevis and abductor longus pollicis manus, and afterward between the two layers of the posterior muscles of the fore-arm as far as the posterior surface of the carpus, where it anastomoses with the anterior interosseous. It gives numerous twigs to most of the posterior muscles of the fore-arm. *Superficial palmar arch*.—Below the pisiform bone the ulnar artery descends in front of the annular ligament of the carpus, and curves from within outward, in the palm of the hand, to form the superficial palmar arch, which terminates by communicating with the radial, near the upper extremity of the second metacarpal bone. The concavity of the arcade, turned upward, gives ramuscles to the lumbricales muscles and to the annular ligament; its convexity gives off five branches, termed the collateral arteries of the fingers. The first of these arteries descends first on the muscles of the little finger, and then on its curved edge, and goes to its extremity. The other branches descend in the interosseous spaces to the metacarpo-phalangeal articulations, where they divide each into two branches, which follow the corresponding edge of the four fingers and the inner edge of the thumb. They are distributed to all parts of the fingers, and anastomose by arches in the pulp of these organs.

## 3. ARTERIES FURNISHED BY THE THORACIC AORTA.

*Bronchial arteries.*—Generally two in number, one on the right side, the other on the left; the former arises from the aorta, or from the first intercostal, and advances under the bronchus of that side as far as the root of the right lung, after giving some ramuscles to the parts adjacent. The latter arises from the anterior part of the aorta, and passes behind the left bronchus. The arteries penetrate the pulmonary tissue, and there subdivide, the right into five branches, the left into four. These latter penetrate into the pulmonary tissue, and there subdivide like the bronchi, accompanying their ramifications.

*Œsophageal arteries.*—From two to five or six in number. They arise from the anterior part of the aorta, give some ramuscles to the pleuræ, aorta, &c., curve to the right and downward, and ramify in the Œsophagus.

*Posterior mediastinal.*—These are very numerous; they arise from the anterior part of the aorta, and ramify in the posterior mediastinum and on the walls of the aorta.

*Inferior intercostal.*—From nine to ten on each side; they arise from the posterior lateral parts of the aorta; they ascend obliquely on the bodies of the dorsal vertebræ, and advance towards the posterior extremity of the ribs. Entering the intercostal spaces, each divides into two branches, a dorsal and an intercostal. The dorsal penetrates the vertebral canal by the corresponding hole of conjugation, and ramifies on the spinal marrow; it then passes out between the transverse processes to the dorsal and lumbar muscles, and some go to the integuments. The latter is larger, proceeds in the middle of the intercostal space beneath the pleura, and soon divides into an inferior and a superior branch. The *inferior intercostal* proceeds along the upper border of the rib which is beneath, and ramifies in the periosteum; the *superior intercostal* passes along a groove in the inferior border of the rib superior to it, and towards the

anterior third of the rib it is directed to the middle of the intercostal space. It gives many secondary twigs to the intercostal muscles and the pleura, some of which go to the muscles and integuments of the chest. Finally, the intercostal branch terminates in front of the thorax, by anastomosing with the internal mammary, or by being distributed in the muscles of the abdomen, according as the artery corresponds to the true or false ribs.

#### 4. ARTERIES FURNISHED BY THE ABDOMINAL AORTA.

*Inferior right diaphragmatic artery.*—Arising from the aorta, it mounts a little to the outer side, along the free border of the right pillar of the diaphragm, to which it gives several branches, as also to the capsula renalis, pancreas, and liver. It divides into two branches. An anterior, which passes between the liver and the diaphragm, and anastomoses with the external branch; in its course it sends off many twigs, which are distributed to the lower face of the diaphragm, and anastomose with the other arteries of the same organ; some go to the upper face of the liver, others to the lower part of the pericardium. The external branch is directed transversely outward, and ramifies in the right part of the diaphragm; it sends two or three branches to the surrenal capsule.

*Inferior left diaphragmatic.*—It arises with the preceding, passes outward in front of the left pillar of the diaphragm, to which it sends branches, as also to the œsophagus and surrenal capsule; and arriving at the phrenic centre it divides into two branches; the anterior branch goes to the anterior part of the diaphragm, and there subdivides, like the anterior branch of the preceding artery; the external branch is larger than the anterior, goes transversely outward, and ramifies to the left part of the diaphragm.

#### • CÆLIAC ARTERY.

[*Preparation.*—Open the abdomen; draw the stomach downward and to the left, and the liver upward and to the right; divide the gastro-hepatic epiploon.]

It arises from the aorta, between the pillars of the diaphragm, opposite the articulation of the last dorsal vertebra with the first lumbar; it passes horizontally forward and to the right side, and shortly divides into three branches; the coronary stomachic, the hepatic, and splenic. *Relations*.—Superiorly with the left side of the lobulus spigelii of the liver, inferiorly with the pancreas; on the left side with the cardia, on the right with the pylorus. *Branches*.—1st, *Coronary stomachic*.—It passes upward, forward, and to the left side; approaches the cardiac orifice of the stomach, follows the lesser curvature of this latter as far as the pylorus, where it anastomoses with the pyloric. It furnishes œsophageal and gastric branches. Of the former there are sometimes several, but often only one, which is vertical, which ascends on the œsophagus, and is distributed to its parietes; others are transverse, and surround the cardiac orifice. The gastric branches are numerous, and arise along the small curve of the stomach, and are distributed on the two faces of this viscus, between its muscular and mucous membrane. 2d, *Hepatic*.—This passes transversely to the right and forward, under the lobulus spigelii, as far as the pylorus and neck of the gall-bladder; in this course it gives off the *pyloric branch*, which lies on the right side of the pylorus; passes from right to left along the small curvature of the stomach, anastomosing with the stomachic coronary branch, and ramifies on the surface of the stomach and on the pylorus. It also supplies the *right gastro-epiploic artery*, which arises on the right and below the pylorus; descends vertically behind the stomach, and goes from right to left, along its greater curvature, in the triangular space left by the folds of the great omentum, as far as the middle of the curve, where it anastomoses with the left artery of the same name; this furnishes numerous branches to the two surfaces of the stomach, and sends a small branch to the pancreas. Along the great curve of the stomach it gives off superiorly numerous twigs to the two faces of the stomach, and



inferiorly a less number of twigs which descend vertically between the layers of the great epiploon. Some of the latter reascend and are reflected to the arch of the colon. The hepatic artery now ascends towards the right side, in front of the vena porta, behind the hepatic duct, as far as the transverse fissure of the liver, where it divides into two branches. The right branch gives off the *cystic artery*, which supplies the parietes of the gall-bladder, and then dips into the transverse fissure of the liver, and ramifies in its right lobe; the left branch penetrates by the same fissure, and is distributed to the left lobe and lobulus spigelii, accompanying the divisions of the vena porta. 3d, *Splenic*.—This artery passes from right to left, along the superior part of the pancreas as far as the fissure of the spleen; in this course it gives off the *pancreatic branches*, which supply the pancreas; and the *left gastro-epiploic*, which ascends a little to the left, towards the great extremity of the stomach, and then descends along the greater curve, at the middle of which it anastomoses with the corresponding artery of the right side. Near the spleen the splenic artery divides into five or six branches, which penetrate this viscus after having given off the *rasa brevia*, which gain the large extremity of the stomach near the cardia, and ramify on its surface.

*Superior mesenteric artery*.—This arises from the anterior right part of the aorta, a little beneath the celiac, and passing downward a little to the left, and forward behind the pancreas, it gains the superior extremity of the mesentery, between the two folds of which it descends, passing from left to right, and forming a curve, the convexity of which is turned to the left and forward. It terminates at the end of the ileon, anastomosing with the inferior right colic artery. Near its origin it gives off some branches to the duodenum and pancreas. In the mesentery the *right colic arteries* arise from its convexity.

The *superior right colic artery* goes horizontally from behind forward, between the two layers of the transverse mesocolon to the centre of the arch of the



colon. There it divides into two branches, which separate. The right follows the right part of the transverse colon, and anastomoses with the upper branch of the middle right colic artery; the left follows the left part of the same intestine, and anastomoses with the ascending branch of the superior left colic artery. The *middle* right colic artery arises below the preceding, goes forward to the right and a little upward in the mesocolon and towards the right lumbar colon, divides into two branches, one of which curves to the left, and anastomoses with the right branches of the superior colic artery, while the other communicates with the ascending branch of the left inferior colic artery.

The *inferior* right colic artery goes transversely to the right, and divides near the cæcum into three branches. The first curves from below upward, and unites with the descending branch of the preceding; the second anastomoses in the mesentery with the extremity of the inferior mesenteric artery; the third goes to the posterior part of the colon and the cæcum, sends a small twig to the vermiform appendix, and divides into two twigs, one of which ascends behind the colon, and the other descends behind the cæcum.

The *superior, middle, and inferior right colic arteries* anastomose together, and thus form arches, the convexities of which are turned towards the intestines, and from whence numerous branches are sent off to the surfaces of the same, passing beneath their serous tunic. The convexity of the superior mesenteric artery gives off fifteen or twenty branches, which go obliquely downward and to the left, between the two layers of the mesentery. Each soon divides into two twigs, which separate, curve, and anastomose by arches with those of the adjacent branches. From the convexity of these arches other twigs arise, which divide in a similar manner, and unite with the adjacent twigs to form new secondary arches. Thus we have three series of successively decreasing arches. The last is very near

the concave edge of the small intestine, gives off numerous ramuscles, which ramify between the mucous and muscular tunics of the intestine.

*Inferior mesenteric artery.*—It arises from the anterior and left part of the aorta, at about an inch and a half from its bifurcation; it descends first a little to the left, enters the iliac mesocolon, forming a curve, the convexity of which is to the left side; it accompanies the rectum as far as the anus, and sends off from its convexity the *superior, middle, and left colic arteries*. The superior is directed transversely to the left, and divides near the left lumbar colon into two branches, one of which ascends to the transverse colon, to unite with the left branch of the superior right colic artery, while the other anastomoses in the iliac mesocolon with the ascending branch of the middle left colic artery. This last named vessel divides near the first curve of the iliac colon into two branches, one of which anastomoses with the descending branch of the superior left colic artery, and the other with one of the branches of the inferior left colic artery. The *inferior* left colic artery divides near the middle of the iliac colon into two branches: a superior, which anastomoses by an arch with the preceding; and an inferior, which unites with a twig given by the inferior mesenteric to the mesorectum. The three left colic arteries, on arriving at the intestine, are distributed like those of the right side. The superior anastomoses near the transverse colon with the left branch of the superior right colic artery. The three arteries, reaching the intestines, are distributed like the preceding. When the inferior mesenteric arrives at the posterior part of the rectum, it divides into the *superior hæmorrhoidal arteries*, which descend along the posterior surface of this intestine, enter its muscular fibres, and anastomose with the middle and inferior hæmorrhoidals.

#### LATERAL BRANCHES OF THE ABDOMINAL AORTA.

*Surrenal arteries.*—One on each side; they arise a little above the renal, pass transversely across the

vertebral column, gain the anterior border of the surrenal capsules, and divide into several branches, which ramify in their substance, and give ramuscles to the colon, diaphragm, spleen, duodenum, &c.

*Renal, or emulgent arteries.*—These are large and very short. One on each side, arising beneath the preceding and superior mesenteric; the left is a little more anterior than the right. Passing transversely across the vertebral column, they are covered by the renal vein and peritoneum, and on the right side by the inferior vena cava; arriving at the fissure of the kidney, they divide into two, three, or four branches, which enter between the pelvis of the kidney and renal vein, and subdivide in turn into ramuscles, which form, by their anastomoses around each fasciculus of tubes, an arch, the convexity of which gives numerous ramifications to the cortical substance.

#### SPERMATIC ARTERIES.

[*Preparation.*—The folds of intestines raised, we find these arteries in front of the psoas muscles; we follow them to the testicle, after dividing the scrotum parallel with the cord.]

Long, extremely tortuous, two in number, arising from the anterior or lateral parts of the aorta, and sometimes from the renal; they descend obliquely outward on the sides of the vertebral column, in front of the psoas muscles and ureters, and pass along with the spermatic veins. *In the male.*—They pass out by the inguinal ring with the vas deferens, and send some branches to the spermatic cord. They terminate by dividing into two branches, one for the epididymis, the other for the superior border of the testicle, and give many twigs to the tunica albuginea, which are distributed to the fibrous septa placed between the layers of the seminal passages. *In the female.*—They pass to the ovary; most of its branches are distributed to this organ, to the Fallopian tubes, round ligament, and sides of the uterus,

## LUMBAR ARTERIES.

Of these there are from three to five on each side; they are directed transversely outward, on the centre of the bodies of the first four lumbar vertebræ, give some ramuscles to this bone, to the pillars of the diaphragm, and to the psoas muscles, and, on coming to the base of the transverse processes, each divides into a dorsal or posterior, and a lumbar or anterior branch. The posterior branches are very small, and send first a twig to the medulla, and then penetrate into the sacro-spinalis muscle, where they terminate. The anterior branches vary; that of the first lumbar artery follows the lower edge of the twelfth rib, and then descends almost vertically before the peritoneum, and is distributed to the transversalis abdominis muscle. The anterior branch of the second lumbar artery goes to the quadratus lumborum muscle; that of the third proceeds between the quadratus lumborum and transversalis abdominis, and divides near the posterior third of the iliac crest into two branches, which descend to the glutæi muscles, where they are distributed. Finally, the anterior branch of the fourth goes transversely between the psoas and quadratus lumborum muscles, gives several twigs to the iliacus muscle, and is distributed, like the preceding, in the glutæi muscles.

## 5. ARTERIES RESULTING FROM THE BIFURCATION OF THE AORTA.

*Middle sacral artery.*—It arises from the posterior part of the aorta, a little above its bifurcation; descends vertically on the sacro-vertebral articulation, and on the middle part of the anterior surface of the sacrum, and terminates near the summit of the os coccygis, anastomosing with the lateral sacral arteries. It gives off in its course numerous lateral branches: the first often take the place of one of the inferior lumbar arteries, and anastomose with the ilio-lumbar arteries; the next go transversely out-

ward on the anterior face of the sacrum, and communicate, near the anterior sacral foramina, with the branches of the lateral sacral arteries.

#### PRIMITIVE ILIACS.

Formed by the bifurcation of the aorta, on a level with the body of the fourth lumbar vertebra, or on the fibro-cartilage between that and the fifth. Separating from one another, they descend as far as the sacro-iliac articulations, where they divide each into the external iliac and internal or hypogastric. The primitive iliac on the right side passes in front of the termination of the vein of the same name, and partly covers the inferior vena cava; the left is in relation, on the inner side and posteriorly, with the primitive iliac vein of the same side. They furnish no branches during their course.

#### INTERNAL ILIAC, OR HYPOGASTRIC.

[*Preparation.*—First separate the vertebral column from the pelvis, between the fourth and fifth lumbar vertebræ; remove one of the ilia, and expose the posterior face of the sacrum and of the glutæus maximus, then cut this last muscle at its internal attachment, turn it back and fix it outward, preserving the twigs of the superficial glutæal and ischiatic arteries; next detach the glutæus medius at its upper insertion, after examining the twigs of the superficial branch of the glutæal artery, which are distributed on its external face; we depress this muscle, and perceive, above the upper edge of the pyramidalis, the trunk of the glutæal artery, which must be followed; we find the ischiatic artery under the lower edge of the same muscle; we discover the internal pudic artery by separating carefully the two sacro-sciatic ligaments, between which it is situated. We then remove the surrounding cellular tissue, and follow the artery in its course to the penis and clitoris; we then dissect the intra-pelvic portion of the hypogastric artery, which is easily followed by making the incisions above mentioned.]

It descends nearly vertically into the cavity of the pelvis, in front of the sacro-iliac articulation, and divides, after a short course, into the following branches:—the posterior, the anterior, the internal, and the inferior branches.

*Ilio-lumbar artery.*—On a level with the base of the

saerum, aseends a little backward and outward behind the psoas muscle, and soon divides into two branches, an aseending and a transverse. The ascending branch proceeds behind the psoas muscle, on the ossa ilia and the last vertebra, and terminates by uniting to the fourth or fifth lumbar artery. It gives twigs to the psoas, iliacus, quadratus lumborum muscles, &c.; one of the largest enters into the vertebral canal, and is distributed to the dura mater and nerves of the extremity of the medulla. The transverse branch goes outward between the psoas and iliaeus museles, and soon divides into superficial twigs, which are distributed on the anterior face of the iliacus musele, and into deep branches, which ramify in this musele. One of them penetrates into the ossa ilia through the hole seen in the iliac fossa.

*Lateral sacral artery.*—Varies in its origin; sometimes one, sometimes two on each side; descending obliquely inward, in front of the anterior sacral foramina, as far as the summit of the os coccygis, where it anastomoses with the middle sacral artery. It sends off external and internal branches; the former enter by the saeral canal, and, ramifying on the dura mater, pass out and are lost in the muscles at the posterior part of the sacrum; the latter ramify in the saeral nerves and ganglia, and in the pyramidalis musele.

*Posterior iliac, or glutæal artery.*—It descends outward and backward, and comes out from the pelvis through the superior part of the sacro-seiatic notch, above the pyramidalis musele. It then passes to the posterior part of the pelvis, covered by the great glutæus musele, and divides into two branches. The *superficial* branch passes a little outward between the glutæus maximus and medius, and ramifies in these muscles and on the posterior sacro-seiatic ligament. The *deep-seated* branch aseends from behind forward between the glutæus medius and minimus, as far as the antero-superior spinous process of the ilium, and sends off numerous branches for the muscles of this region, for the ilium itself, for the tensor

vaginæ femoris, and capsule of the ilio-femoral articulation.

*Umbilical artery.*—It goes obliquely forward and inward as far as the superior lateral part of the bladder, from whence it ascends behind the anterior parietes of the abdomen as far as the umbilicus. In the adult this artery is almost completely obliterated, but in the fœtus it is very large, and appears the continuation of the internal iliac, and passes out by the umbilicus, forming a part of the umbilical cord, and goes to the placenta.

*Vesical arteries.*—They vary in number and origin. They arise from the umbilical, middle hæmorrhoidal, internal pudic, and obturator arteries. The internal iliac sends off a considerable branch, which supplies the fundus of the bladder, commencement of the urethra, prostate gland, vesiculæ seminales, and vas deferens.

*Obturator artery.*—It arises from the internal iliac, or from the glutæal, and sometimes, but rarely, from the epigastric; it passes forward on the internal obturator muscle, and advances as far as the obturator foramen, the superior part of which it traverses. On leaving the pelvis it divides into a posterior and anterior branch; the former passes outward beneath the quadratus femoris, and supplies the back part of the thigh, the ilio-femoral articulation, and the acetabulum; the latter descends between the first and second adductors, which it supplies, as also the external obturator, pectineus, vastus internus, and integuments, and anastomoses with a branch of the posterior.

*Middle hæmorrhoidal artery.*—It descends obliquely on the anterior part of the rectum, and supplies the tunics of this intestine, and anastomoses with the superior and inferior hæmorrhoidal arteries.

*Uterine artery.*—Its volume is always in relation with the state of the uterus. It arises from the hypogastric or internal pudic, passes into the broad ligament, and joins the lateral and inferior parts of the uterus, where it ramifies; some ramuscles go to the Fallopian tube and on the round ligament.



*Vaginal artery.*—This is not constant; it arises from the internal pudic, middle hæmorrhoidal, or umbilical; passes along the lateral parts of the vagina as far as its orifice, and sends off branches which supply this organ and the external parts of generation.

*Ischiatic artery.*—This seems to be the continuation of the hypogastric; after supplying the rectum and bladder, it descends nearly vertically in front of the pyramidalis muscle, and comes out from the pelvis through the great sciatic notch, between the superior border of the latter muscle and the anterior sacro-sciatic ligament. At its exit from the pelvis it divides into several branches; one goes downward and inward, gives twigs to the glutæus maximus, and is distributed in the ischio-coccygeal and levator ani muscles; another is distributed to the lower third of the glutæus maximus; the third accompanies the sciatic nerve to the lower part of the thigh, and is distributed to the muscles of the posterior crural region.

*Internal pudic artery.*—Not so large as the ischiatic, and very often sent off from it. It descends in front of the sciatic plexus and pyramidalis muscle, and comes out from the pelvis by the inferior part of the great sciatic notch, between the pyramidalis and posterior border of the levator ani. It then passes downward and inward between the two sacro-sciatic ligaments, curves round the anterior one, and gets on the internal surface of the ischium between the internal obturator muscle and levator ani; passes horizontally forward and inward as far as the common attachment of the erector penis and transversus perinæi, and here divides into two branches, which take a different course in the male and in the female.

In the pelvis it gives some branches to the bladder, vesiculæ seminales, rectum, &c.; on the outer side it furnishes small branches to the sphincter ani and levator ani, and external branches which go to the upper attachment of the flexor muscles of the leg.

1. *Inferior branch, or perinæal artery.*—It proceeds for-



ward, between the skin and transversus perinæi, a little nearer the ramus ischii than the raphe, and advances as far as the lower part of the scrotum, supplying the levator ani, transversus perinæi, erector penis, and accelerator urinæ; some branches pass towards the rectum under the name of the *inferior hæmorrhoidal*. Farther on, the inferior branch penetrates the septum scroti, and supplies it and the dartos muscle, as also the skin of the penis. 2. *Superior branch*.—It ascends above the transversus perinæi, along the ascending branch of the ischium and ramus of the pubis, as far as the symphysis of this latter bone, where it divides into two branches, the *dorsal artery of the penis*, and *artery of the corpus cavernosum*. Near its origin the superior branch of the pudic gives off the *transverse artery of the perinæum*, which passes inward and forward, above the transversus perinæi muscle, to the bulb of the urethra, into which it penetrates and ramifies. The *artery of the corpus cavernosum* passes into the corresponding side of the corpus cavernosum, and divides into a great number of branches, which supply its tissue. The *dorsal artery of the penis* traverses the suspensory ligament of this organ, descends along its dorsal face, supplying the fibrous membrane of the corpus cavernosum and the skin, and ramifying in the glans penis. In the female, the inferior branch of the internal pudic follows the same course as in the male; after giving off branches to the transversus perinæi, sphincter ani, and constrictor vaginæ, it terminates in the greater labia; the superior branch ascends along the ischium and pubis as far as the root of the corpus cavernosum of the clitoris, gives off a branch to the plexus which surrounds the orifice of the vagina, and divides, in front of the symphysis of the pubis, into two branches, one of which penetrates the corpus cavernosum, the other ramifies on the dorsum of this organ.

#### EXTERNAL ILIAC ARTERY.

It is formed by the bifurcation of the primitive iliac, and extends from the sacro-iliac symphysis as far as

the crural arch, where it takes the name of femoral. It descends obliquely outward along the internal anterior part of the psoas muscle, having on the posterior and inner side the external iliac vein; before traversing the crural arch it gives off two branches, the epigastric and circumflex iliac. 1. The *epigastric artery* arises from its inferior and internal part, on a level with the upper extremity of the inguinal ring, a little above the crural arch, passes immediately inward and a little forward behind the spermatic cord, the direction of which it crosses; it afterward passes to its inner side, and ascends towards the external border of the rectus abdominis muscle. About two inches above the pubis it passes on the posterior surface of this muscle, and terminates at the umbilicus. Near its origin it supplies the peritoneum and spermatic cord; one of its branches passes through the inguinal ring, supplying in the male the cremaster muscle, tunica vaginalis, and scrotum, and in the female the round ligament and superior part of the vulva; the other twigs of this artery are distributed on the inside to the rectus muscle, and on the outside to the other abdominal muscles. 2. The *circumflex iliac artery* arises from the external part of the external iliac; it mounts obliquely outward, along the external border of the iliacus muscle as far as the upper part of the antero-superior spinous process of the ilium; it then passes backward, and divides into two branches after supplying the abdominal muscles and iliacus; its external branch ascends between the transversalis and internal oblique muscles, in which it is lost; its internal branch follows for some time the direction of the crista ilii, and ascends a little obliquely backward to be lost in the same muscles.

#### FEMORAL ARTERY.

[*Preparation.*—Make an incision in the skin from the centre of the crural arch to the inner condyle of the femur; dissect the integuments and turn them back. We then prepare the tegumentary artery of the abdomen and the external pudic; divide the crural aponeurosis, and turn it back; divide the sartorius muscle, separate the sartorius, rectus, triceps femoris, and tensor vaginæ,

to discover the external circumflex and its branches: we then follow the profunda to near the lower part of the third adductor. At the posterior part of the thigh turn back the glutæus maximus, after dividing and separating the muscles attached to the ischium, to see the perforating arteries and the transverse branch of the internal circumflex.]

It is situated at the anterior and inner part of the thigh; it commences beneath the crural arch, very nearly in the space between the antero-superior spinous process and the spine of the pubis. It descends obliquely outward along the internal anterior part of the psoas muscle, applied posteriorly and on the inner side on the external iliac vein; towards the inferior part of the thigh it enters the aponeurotic sheath of the great adductor muscle, on its exit from which it takes the name of popliteal artery. Its direction is obliquely from above downward, from without inward, and from before backward. *Relations*.—Anteriorly with the crural aponeurosis, integuments, and inguinal lymphatic ganglia; lying in a triangular space, bounded above by the crural arch, on the outer side by the sartorius, and on the inner side by the middle adductor and vastus internus; more inferiorly, it is crossed by the sartorius; posteriorly, and from above downward, it is in relation with the body of the pubis, from which it is separated by the pectineus, afterward with the middle and small adductors; on the outer side, in the same direction, with the crural nerve, the tendon of the psoas and iliacus muscles, the sartorius, and lastly, the internal portion of the triceps, which separates it from the body of the femur; on the inner side with the femoral vein, the pectineus muscle, the first adductor, and the sartorius.

*Branches*.—The femoral artery gives off internal, external, anterior, and posterior branches. 1. *External pudic*.—Of these there are two: the superficial arises near the crural arch, proceeds transversely inward, and divides into two branches; the superior, which is distributed to the integuments of the lower part of the abdomen; and the inferior, which is distributed to the scrotum and skin of the penis in the

male, and to the great labia in the female; the deep-seated branch passes transversely inward, under the crural aponeurosis, which it pierces, and goes to the scrotum or labia, according to the sex.

The other internal branches of the femoral artery go to the rectus and middle adductor, and to the integuments.

2d. *Superficial muscular branch*.—It arises nearly on a level with the profunda; it passes transversely outward between the sartorius and rectus, and soon divides into ascending and descending branches, which supply the muscles and integuments of the upper part of the thigh. The other external branches are very small. 3d. *External epigastric*.—It is very small, and arises immediately above the crural arch; mounts outward between the abdominal aponeurosis and integuments, to which it is distributed, terminating on a level with the umbilicus. The other anterior branches are very small. 4th. *Profunda*.—This is very large; it arises an inch and a half or two inches below the crural arch, towards the middle of the space comprised between the pubis and lesser trochanter; it descends backward between the adductor muscles and internal portion of the triceps as far as the middle part of the thigh. It then passes to the posterior part of the limb, after traversing the aponeurosis of the middle adductor, and divides into two branches, one of which enters the short portion of the biceps, and the other the semi-membranosus. In this course it gives off, on the outside, the external circumflex; on the inside, the internal circumflex; and posteriorly, the three perforating arteries. The *external circumflex* arises from its external side, passes outward behind the sartorius and rectus, and divides into two branches; the first, the transverse, gains the postero-external part of the femur, supplying the ilio-femoral articulation, external portion of the triceps, glutæus medius and minimus, tensor vaginæ femoris, and rectus; the second descends between the triceps and rectus, in which it ramifies. The *internal circumflex* arises from the internal part of the profunda; it dips

from before backward, between the pectineus and united tendons of the psoas and iliacus muscles; turns on the internal part of the femur, and after giving branches to the neighbouring parts, gains the posterior surface of the neck of the same bone, where it divides into two branches, one of which mounts obliquely on the neck of the femur, supplying the acetabulum, quadratus femoris, gemelli, and internal obturator muscles; the other is lost in the flexors of the leg and superior part of the great adductor. The *superior perforating artery* arises beneath the lesser trochanter, passes backward, traverses the aponeurosis of the second and third adductors, and, gaining the posterior part of the femur, divides into two branches, which supply the glutæus maximus, biceps, external portion of the triceps, and semi-membranosus. The *middle perforating artery* traverses also the aponeurosis of the second and third adductors, supplying the muscles of the posterior part of the thigh; one of these branches penetrates the femur. The *inferior perforating artery* passes through the aponeurosis of the great adductor, and follows the course of the preceding.

#### POPLITEAL ARTERY.

The continuation of the femoral artery, which changes its name on traversing the great adductor. It is situated at the lower and posterior part of the thigh, in the ham, and at the upper and posterior part of the leg. *Extent.*—From the commencement of the inferior third of the thigh as far as the end of the superior fourth of the leg, where it terminates in dividing. *Relations.*—Posteriorly with the sciatic nerve, popliteal vein, and semi-membranosus; afterward and more inferiorly with the gastrocnemius, plantaris, and soleus; anteriorly, and from above downward, with the femur, femoro-tibial articulation, popliteus, and tibialis posticus muscles; on the outer side with the biceps, external condyle of the femur, plantaris, and soleus; on the inner side with the semi-membranosus and internal popliteal nerve.

*Branches.*—The popliteal artery gives off a great number of small branches to the adjacent parts. Many which are larger arise in or below the ham, and are termed the articular arteries. *Superior articular arteries.*—Three in number, arising from the popliteal in the ham. 1st, *The internal.*—Sometimes there are two or three. After its origin, which varies much, it descends inward, passes under the tendon of the third adductor, turns anteriorly on the internal part of the femur, above the corresponding condyle, and divides into two branches, which pass outward, and are lost in the triceps and articulation of the knee joint. 2d, *The external.*—Passing outward, it turns on the external part of the femur, above the corresponding condyle, and divides into two branches, the superior of which is lost in the triceps, the inferior descends obliquely on the external condyle of the femur. 3d, *The middle.*—This arises from the anterior part of the popliteal; it soon traverses horizontally, from behind forward, the posterior ligament of the articulation of the knee, and divides into two branches, which supply the cellular tissue and fat posterior to the crucial ligament. The other is distributed in the fat found between the two condyles of the femur. *Inferior articular arteries.*—Two in number, arising from the popliteal at the superior part of the leg, and divided into the internal and external. *The internal* descends obliquely inward, and turns immediately beneath the internal tuberosity of the tibia, between the bone and internal lateral ligament of the knee; it afterward ascends along the internal part of the ligamentum patellæ as far as the inferior part of this bone, where it ramifies on the articulation and periosteum of the tibia. *The external* descends obliquely outward between the popliteus and gastrocnemius, gets under the tendon of the biceps and external lateral ligament of the articulation of the knee, advances along the external border of the external semilunar cartilage to the lower part of the patella, where it divides into two branches; the deep branch gives some ramuscles, which de-

scend on the tibia, and are lost in the fatty cellular tissue placed between the tibia and the ligament of the patella; and the superficial ascends on the patella; the twigs of this artery are distributed to the adjacent muscles, and to the outer part of the knee joint.

The popliteal artery, after giving off the inferior articular arteries, descends behind the popliteal muscle, and furnishes anteriorly the *anterior tibial*; and after passing about an inch, it divides into the *peroneal* and *posterior tibial*.

#### ANTERIOR TIBIAL ARTERY.

*Situation.*—At the anterior part of the leg. *Course.*—After giving some branches to the neighbouring muscles, it is directed forward, and traverses the superior extremity of the tibialis posticus and interosseous ligament; it then descends obliquely to the anterior part of the leg, glides inferiorly beneath the anterior annular ligament of the tarsus, to take the name of the plantar artery. *Relations.*—1st, Posteriorly with the interosseous ligament, and inferiorly with the tibia; 2d, Anteriorly with the tibialis anticus, extensor digitorum communis, and extensor proprius pollicis pedis; 3d, On the inner side with the tibialis anticus and tibia; 4th, On the outer side with the anterior tibial nerve; and from above downward with the fibula, peroneal muscles, extensor digitorum communis, and extensor proprius. *Branches.*—After traversing the interosseous ligament, it gives off the *recurrent artery of the knee*, which passes upward and inward, supplies the upper extremity of the tibialis anticus, and is lost in the articulation of the knee and in the integuments. After supplying the anterior muscles of the leg, the anterior tibial sends off the *external* and *internal malleolar arteries*, which pass to their respective sides, and ramify on the articulation and on the tarsus.

#### PEDICEAL ARTERY.

This is situated on the upper face of the foot. It extends from the termination of the anterior tibial



artery to the posterior extremity of the first metatarsal bone, where it descends to the sole of the foot, passing through the adductor muscle of the second toe. *Branches.*—These are internal or external: the first arc very small, and are distributed to the inner edge of the foot; the second go on the back of the foot and the pedicæus muscle. Two are larger, and are termed the tarsal and metatarsal arterics.

*Tarsal artery.*—It goes outward and a little forward under the pedicæus muscle to the outer edge of the foot, and in this course gives many twigs to this muscle and to the tarsal ligaments. The *metatarsal* artery is directed forward and outward under the pedicæus muscle, on the metatarsal bones, and forms a curve, the concavity of which, turned backward, gives twigs to the tarsal articulations; while the convexity gives off three branches, the *dorsal interosseous arteries of the foot*. These twigs proceed from behind forward, and on coming to the posterior extremities of the metatarsal bones, they communicate with the posterior perforating arteries of the external plantar artery; they then proceed above the dorsal interosseous muscles, which receive ramuscles from them; and, near the metatarso-phalangean articulations, communicate with the anterior perforating arteries. They then divide into two small twigs, which follow the corresponding edges of the toes, from the outer edge of the second to the inner edge of the last, and which are distributed to the skin. Near the posterior extremity of the first metatarsal bone the pedicæal artery gives off a branch, which, on arriving at the first metatarso-phalangean articulation, divides into two twigs, one for the outer side of the first toe, the other for the inside of the second. When the pedicæal artery has arrived at the sole of the foot, it divides into two branches: the external contributes to form the plantar arch by anastomosing with the external plantar; the internal proceeds between the first two metatarsal bones, gives twigs to the oblique abductor and small flexor of the



great toe, and divides into two twigs, which go to the outside of the first toe and inside of the second.

#### PERONEAL ARTERY.

*Situation.*—At the posterior and deep part of the leg, along the border and internal surface of the fibula. *Extent.*—From the end of the popliteal artery to the external malleolus. *Relations.*—Posteriorly with the soleus and flexor longus pollicis pedis; anteriorly and superiorly with the tibialis posticus; anteriorly and inferiorly with the interosseous ligament. It furnishes numerous branches to the posterior muscles of the leg, and near the external malleolus it divides into the posterior and anterior fibular arteries. The former of these descends behind the inferior articulation of the fibula, where it gives many branches to the lower part of the posterior muscles of the leg, &c. It then passes on the external side of the calcaneum, where it divides into branches which ramify on the superior and external part of the foot. The anterior peroneal artery traverses the inferior extremity of the interosseous ligament, descends on the anterior part of the inferior articulation of the tibia with the fibula, and anastomoses with the anterior tibial artery, forming a small arch, which supplies the neighbouring parts.

#### POSTERIOR TIBIAL ARTERY.

[*Preparation.*—Cut the gastrocnemii at one of their attachments, turn the soleus on the outer face of the fibula, and open the tibial aponeurosis from above downward, along the inner edge of the tendo-Achillis.]

*Situation.*—At the posterior part of the leg, not so deep as the preceding. *Course.*—It descends between the two planes of the posterior muscles of the leg, and terminates underneath the calcaneum by dividing into two branches, termed the plantar arteries. *Relations.*—Posteriorly and superiorly with the gastrocnemius and soleus; posteriorly on the outer side and inferiorly with the tendo-Achillis; anteriorly and

from above downward with the *tibialis posticus*, *flexor longus digitorum pedis*, and posterior surface of the tibia; on the outer side with the external popliteal nerve. It sends off numerous branches, which supply the muscles of the posterior part of the leg, the adductor of the large toe, and *flexor brevis digitorum*; one of them enters the nutritious foramen of the tibia; some twigs are given to the periosteum; some join those of the anterior tibial artery. *Internal plantar artery*.—Passes horizontally from behind forward, along the internal part of the sole of the foot, beneath the adductor of the large toe, and supplying the muscles and integuments in this region, it terminates in anastomosing with the first collateral branches. In its course it gives off a great number of twigs, some of which go to the articulation of the foot, to the adductor muscles of the great toe, the *flexor brevis digitorum*, and the integuments; the others, which are more anterior, are distributed to the same muscles, to the flexor of the little toe, and inside of the foot. *External plantar*.—It is larger than the preceding, and passes downward and outward in the groove of the calcaneum; it proceeds afterward in the space between the *flexor brevis digitorum* and *abductor minimi digiti pedis*. Towards the posterior extremity of the fifth metatarsal bone, it passes between the *abductor proprius pollicis pedis* and *interosseous muscle*, and posterior extremities of the metatarsal bones; turning inward and forward, approaching the first metatarsal bone, it forms, in anastomosing with the continuation of the anterior tibial, the plantar arch, the concavity of which looks backward. From the convexity of the plantar arch numerous branches are sent off, the posterior perforating arteries; and inferior, posterior, and anterior branches, which supply the *lumbricales muscles* and metatarsal articulations, and take a course similar to that of the branches of the palmar arch; each anterior branch supplying the corresponding sides of the toes.

## SECTION II.

## VEINS.

[*Preparation.*—The veins are generally studied without being injected; to dissect them we follow the direction of the corresponding arteries; when, however, injections are required, the dark compound used for the arteries will suffice; but the process differs much, and only a partial injection is possible. Place the tube from below upward in the upper part of the basilic vein, and inject the cerebral and thoracic veins, the inferior vena cava and its branches, the iliac, and hypogastric. We inject the veins of the back of the hand, of the fore-arm, and arm, by introducing the injection through the inferior twigs of the ulnar and radial veins; the abdominal limbs are injected through the inferior twigs of the two saphenæ.]

## 1. PULMONARY VEINS.

These arise in the tissue of the lungs, terminate by collecting into four trunks, two for each lung, which pass out by the middle of the internal surface of this organ, beneath the bronchial tubes, and, penetrating the pericardium, open into the posterior part of the left auricle.

## 2. OF THE VEINS WHICH FORM THE EXTERNAL JUGULAR.

The *internal maxillary* and *superficial temporal veins*, which arise by as many branches as their corresponding arteries.

## EXTERNAL JUGULAR VEIN.

The external jugular, which results from the anastomosing of these veins, descends nearly vertically along the lateral anterior part of the neck, between the sterno-mastoideus and platysma myoides, and near the external border of the first of these muscles; at the inferior part of the neck it opens into the superior part of the subclavian vein, a little on the outer side of the internal jugular. In its course the external jugular receives the cutaneous cervical and

brachio-scapular veins, and near its termination other veins, which follow the clavicle, and form above the upper end of the sternum a venous plexus, which is augmented by four or five large veins from the muscles of the superior hyoid region.

#### THE VEINS GIVING ORIGIN TO THE INTERNAL JUGULAR.

These are the *superior cerebral veins*, those of the corpora striata, the *venæ Galeni*, the *superior* and *inferior cerebellic*, *inferior cerebral*, the *ophthalmic*, the *facial*, the *lingual*, the *pharyngeal*, and the veins of the diploe of the bones of the cranium.

#### INTERNAL JUGULAR VEIN.

The internal jugular vein, which is the result of these various branches, commences beneath the foramen lacerum posterius; it descends a little forward with the internal carotid artery, covered by the styloid process and muscles which are attached to it, and, arriving on a level with the superior part of the larynx, it receives the facial, lingual, pharyngeal, and diploic veins; it then descends vertically along the anterior lateral part of the neck, behind the sternomastoides, in front of the anterior rectus, vertebral column, and anterior scalenus; and on the outer side of the primitive carotid and par vagum it opens into the subclavian vein, after receiving some middle thyroid veins from the thyroid gland.

#### VEINS GIVING ORIGIN TO THE SUBCLAVIAN.

These are the *brachial veins*; the *cephalic*, which commences on the back of the hand, mounts along the anterior external part of the fore-arm, under the name of the *radial vein*, which, at the fold of the arm, unites with the *median cephalic*, which communicates with the *median basilic*. The trunk of the cephalic, formed by this junction, mounts along the external border of the biceps, and, passing between the deltoid and pectoral muscles, opens into the axillary. The

*basilic vein* is formed by the anterior and posterior ulnar veins, the latter of which, arising from the internal part of the back of the hand and posterior surface of the fingers, forms the *vena salvatella*; the median basilic descends obliquely on the outer side of the trunk of the basilic, along the tendon of the biceps, and joins the median cephalic. Formed by these branches, the basilic vein mounts along the internal part of the arm, in front of the ulnar nerve, enters the axilla, and is continuous with the axillary vein. The axillary vein, formed by all the thoracic, mounts obliquely inward, beneath the clavicle, and in front of the axillary artery; it then becomes continuous with the subclavian. The *vertebral*, *right superior*, and *left superior intercostal veins* also go to form the subclavian.

#### SUBCLAVIAN VEIN.

The subclavian, which is the result of all these veins, extends from the inferior extremity of the anterior scalenus as far as the superior vena cava, which it forms in uniting with that of the opposite side. It differs somewhat on the right and on the left side; that of the right side is shorter, covered by the sternomastoideus, sterno-clavicular articulation, cartilage of the first rib, and a small portion of the sternum; it is applied on the outer and posterior side against the right fold of the mediastinum, the par vagum, right subclavian artery, and anterior scalenus; on the inner side it is in relation with the aorta. That of the left side is longer and more horizontal than the right, covered by the same parts, and also by the sternum; it covers, besides the parts similar with the right, the arch of the aorta and *arteria innominata*; it receives the left internal mammary and left inferior thyroid veins.

#### VEINS FORMING THE SUPERIOR VENA CAVA.

Before penetrating the pericardium, the superior vena cava receives the *internal mammary* of the right

side, the *inferior thyroid* of the same side, and *vena azygos*. This latter opens into the two *venæ cavæ*, between which it forms a communication; it arises from the posterior part of the superior vena cava, immediately above the right bronchus, and, curving from before backward, and a little from left to right, it forms an arch around this latter and the pulmonary artery; it descends afterward on the right side of the anterior part of the bodies of the dorsal vertebræ, and traversing the pillars of the diaphragm, opens into the inferior vena cava, and sometimes into one of the lumbar veins.

#### SUPERIOR VENA CAVA.

The superior vena cava is formed by the union of the two subclavian veins, extends from the cartilage of the first rib, on the right side, as far as the right auricle. It commences a little above the arch of the aorta, descends at first to the left and forward as far as the base of the pericardium; it then passes vertically to the right of the aorta, and opens into the right auricle a little above the inferior vena cava. Anteriorly it is in relation with the thymus gland and anterior mediastinum; posteriorly with the superior pulmonary vein of the right side and aorta; on the right side with the lung; on the left with the pericardium.

#### THE VEINS GIVING ORIGIN TO THE INFERIOR VENA CAVA.

The *popliteal vein* is similar to the artery of the same name, which it accompanies. The *external saphena* vein, which commences on the dorsum of the foot, passes behind the external malleolus, and mounts along the tendo-Achillis, and in the ham opens into the popliteal vein. The *femoral vein*, following the artery of the same name, receives near the crural arch the *internal saphena* vein, which, coming from the internal border of the large toe, passes in front of the internal malleolus, mounts along the internal part of the leg, passes behind the internal condyle of the

femur, and ascends along the inner part of the thigh, and near the crural arch opens into the femoral. These veins at length form the *external iliac*, which is situated beneath and a little on the inner side of the artery of the same name; it is the continuation of the femoral. The *internal iliac vein*, formed by the *vesical* and *lateral veins of the sacrum*, lies behind the artery of the same name, and with the external forms the *primitive iliac*, which extends from the sacro-iliac symphysis as far as the articulation of the fourth and fifth lumbar vertebræ, where they unite to form the inferior vena cava.

#### INFERIOR VENA CAVA.

The inferior vena cava, formed indirectly by these branches, and directly by the union of the *external* and *internal iliac veins*, extends from the articulation of the fourth and fifth lumbar vertebræ to the right auricle of the heart; it passes at first vertically on the lateral part of the right side of the bodies of the lumbar vertebræ, as far as the under part of the liver, and lodges in a groove in this organ; it afterward passes through an opening in the phrenic centre of the diaphragm, penetrates the pericardium, and opens into the infero-posterior part of the right auricle. It receives the *middle sacral, lumbar, spermatic, renal, capsular, hepatic*, and *inferior diaphragmatic* veins. Of these the spermatic veins present a few peculiarities, as do also the renal or emulgent. In the male, the spermatic veins, taking their origin in the testicles, pass across the tunica albuginea, in front of the head of the epididymis, wind around the vas deferens, traverse the inguinal ring, are directed inward and upward, lying on the psoas muscle, and open, the right into the vena cava, the left into the left renal vein. In the female, these veins arise from the ovaries. The course of the renal veins is similar to that of the arteries; they pass transversely inward, and open into the inferior vena cava.



## OF THE VENA PORTA.

The *capsular* veins have the same arrangement as the capsular arteries. The *hepatic* veins are found in the liver; some small ones open separately into the vena cava, as do also two or three which come from the lobulus spigelii. The left hepatic veins empty into the vena cava before, and on a level with the opening of the diaphragm. The right hepatic veins leave the right lobe near the centre of its lower face, and open into the vena cava below the preceding. The *inferior diaphragmatic* veins are analogous to the arteries of the same name.

The *vertebral venous sinuses* are situated in the vertebral canal, before the dura mater, and on the sides of the posterior vertebral ligament, extending from the occipital foramen to the end of the sacrum. They are narrow in the neck, broad in the back, very small in the sacral canal, where they form two veins, which terminate in the fat. *Branches.*—At the anterior condyloid foramen they communicate by a twig situated in this foramen with the internal jugular vein; in the vertebral canal they anastomose with each other and on the inside by means of the transverse sinuses which occupy the centre of each vertebra; they communicate on the outer side with the posterior branches of the vertebral intercostal and lumbar veins; posteriorly they receive the veins of the dura mater of the vertebral canal.

The *cardiac* veins are divided into posterior and anterior. Of the former there are two, the great and the small; they arise near the summit of the heart, receive numerous twigs, and proceed upward, uniting on the wall of the right auricle. The anterior are smaller than the posterior, often unite in one trunk, and open conjointly with the other veins at the posterior part of the right auricle, below the inferior vena cava.

The roots of the vena porta arising from all the organs contained in the abdomen, except the kidneys, bladder, and the uterus in the female unite frequently,

and form at length two considerable trunks—the *splenic* and *superior mesenteric*.

*Splenic vein*.—This arises in the spleen by from three to seven or eight branches, which unite on the pancreas into a single trunk; it afterward passes transversely to the right side, beneath the splenic artery, and unites with the superior mesenteric vein; in this course it receives the veins which correspond to the vasa brevia, the right and left gastro-epiploic, the duodenal, the pancreatic, coronary stomachic, and inferior mesenteric arteries.

*Superior mesenteric vein*.—It takes the same course as the artery, arrives at the adherent border of the transverse mesocolon, enters the pancreas, and joins the splenic at an obtuse angle.

The vena porta formed by these veins lies at first under the small extremity of the pancreas, and behind the second portion of the duodenum; afterward, covered by the hepatic artery, ductus choledochus, and hepaticus, it mounts to the right and backward, and having arrived near the right extremity of the transverse groove of the liver, divides into two branches, which separate nearly at a right angle, and form in this place a horizontal canal termed the sinus of the vena porta. The two branches, accompanied in all their divisions by those of the hepatic artery, ramify in the tissue of the liver, and are distributed, the right to the great lobe, the left to the lesser one, and are enveloped by the capsule of Glisson in their whole course.

### SECTION III.

#### LYMPHATIC VESSELS AND GANGLIONS.

##### I. LYMPHATIC GANGLIONS.

*Anterior tibial ganglion*.—It is unmated, and is situated on the lower extremity of the interosseous ligament, between the tibia and fibula.

*Popliteal ganglions*.—Three or four in number, situated in the ham, around the popliteal artery.

*Inguinal ganglions.*—Situated at the anterior and upper part of the thigh, near the groin; the superficial, six in number, are placed between the aponeurosis and the skin, around the internal saphena vein; the deep-seated, from two to four in number, are situated under the aponeurosis around the femoral artery.

*Hypogastric ganglions.*—Ten or twelve in number, on the sides of the cavity of the pelvis, around the internal iliac vessels. They exist sometimes in the course of the glutæal and ischiatic arteries, in the bladder, the uterus, or the vesiculæ seminales.

*Sacral ganglions.*—Situated in front of the sacrum, in the thickness of the meso-rectum.

*External iliac ganglions.*—From six to fifteen in number, situated along the external iliac vessels from the crural arch to the end of the vertebral column.

*Lumbar ganglions.*—These are numerous and very large; situated on the sides of the bodies of the lumbar vertebræ, on the pillars of the diaphragm, aorta, and inferior vena cava, giving rise to the principal roots of the thoracic canal.

*Hepatic, pancreatic, and splenic ganglions.*—Situated around the vena porta and the splenic artery, receiving the lymphatic vessels of the liver, aorta, and pancreas.

*Mesenteric ganglions.*—From one hundred and thirty to one hundred and fifty in number; situated between the two folds of the mesentery; distant at least an inch or two from the small intestine, and larger as they approach the vertebral column.

*Mesocolic ganglions.*—Much fewer than the preceding, situated between the folds of the mesocolon, larger along the arch of the colon than in the other parts of this intestine.

*Gastro-epiploic ganglions.*—Ten or twelve in number, situated along the curves of the stomach, around the coronary stomachic and the gastro-epiploic arteries.

*Mediastinal ganglions.*—Three or four in the dia-

phragm, an equal number on the pericardium, and twelve or fifteen around the thymus gland and the origin of the large vessels.

*Ganglions of the thoracic parietes.*—These are irregularly scattered between the two layers of intercostal muscles. We also find twelve on each side in the costal articulations, some around the œsophagus and aorta, and eight or ten which follow the course of the internal mammary arteries.

*Bronchial glands.*—These have been described above when treating of the bronchi.

*Ganglions of the arm.*—They are situated in the course of the brachial artery, from the fold of the arm to the axilla.

*Axillary ganglions.*—These are very large, and vary in number: they are situated in the axilla, around the axillary vessels and their branches, and in the centre of the cellular tissue.

*Ganglions of the skull.*—There are none in the cavity of the cranium, two or three small ones behind the ear, one or two behind the zygomatic arch.

*Ganglions of the face.*—Some are found on the buccinator muscle, others along the base of the jaw, around the anterior belly of the digastric muscles.

*Ganglions of the neck.*—They are distinguished, 1st, Into superficial ganglions, situated below the platysma muscle, in the course of the external jugular vein; 2d, Into deep ganglions, which are very large and numerous, and are situated around the internal jugular vein and the primitive carotid artery, from the mastoid process to the upper opening of the thorax.

## LYMPHATIC VESSELS.

[*Preparation.*—We inject the lymphatic vessels, like the veins, from their lower extremities. For this we use a glass tube five or six inches in diameter and one or two feet long; purified mercury is the substance most commonly employed for these injections; the subjects generally selected for showing these vessels are thin and dropsical. If we wish, says Macagni, to inject the superficial lymphatics of the upper and lower extremities of the trunk, head, thighs, genital organs, we make in the back of the

foot, hand, and in the integuments of the fingers, an incision with a small scalpel, and separate the fatty layer of the skin, but only to a slight extent. We then perceive several minute vessels, filled with a transparent fluid, the largest of which admit the introduction of a glass tube. We proceed in the same manner for the other lymphatics. The lymphatics of the mesentery are studied by killing an animal three or four hours after it has been fed. These vessels are then dilated by chyle, and are very apparent.]

### 1. LYMPHATICS TERMINATING IN THE THORACIC DUCT.

*Superficial lymphatics of the abdominal limbs.*— Their branches arise from the toes by numerous and very minute twigs, and cover the two faces of the foot. Those of the upper face form, by their successive union, from sixteen to twenty branches, which reascend with the internal saphena vein on the anterior and internal sides of the leg; some attend the external saphena vein, and near or below the knee unite to the twigs of the inner side of the leg. All these twigs then unite at the inner part of the thigh above the patella. Those which come from the sole of the foot and from the posterior face of the leg, reascend around the Achilles tendon and unite to the preceding. All these lymphatics frequently anastomose so as to form a kind of plexus around the lower extremity; ascend along the inner and anterior part of the thigh, and terminate in the superficial inguinal ganglions.

### 2. DEEP LYMPHATICS OF THE ABDOMINAL LIMBS.

They follow the course of the external saphena vein, the anterior and posterior tibial and femoral arteries.

*External saphena lymphatics.*—Of these there are two or three, which arise on the outer part of the back of the foot, ascend along the outer edge of the Achilles tendon, and are then placed between the gemelli muscles; and, on arriving at the ham, they partly join the other deep absorbents, and partly the superficial.

*Anterior tibial lymphatics.*—Of these there are two;

one arises on the sole of the foot, ascends first on the back of this part, and attends the pedicæal artery, and then the anterior tibial artery, and terminates in a small ganglion near the upper extremity of the tibia, or traverses the interosseous ligament to unite with the deep-seated vessels; the other vessel arises at the outer part of the foot, follows the same course to the middle third of the leg, where it unites with the peroneal vessels after passing through the interosseous ligament.

*Posterior tibial lymphatics.*—They arise from all parts of the sole of the foot, and form several trunks, which ascend around the posterior tibial artery to the popliteal ganglions.

*Peroneal lymphatics.*—They arise at the sole of the foot, and attend the peroneal artery, and terminate in the popliteal ganglions. They are united by numerous very short lymphatics, which form a plexus from which two, three, or four trunks proceed, which reascend with the popliteal and femoral vessels, receiving all the deep lymphatics of the thigh, and terminate in the deep inguinal ganglions.

### 3. SUPERFICIAL LYMPHATICS OF THE BUTTOCKS, &c.

*Lymphatics of the buttocks.*—They anastomose frequently, turn on the external and internal parts of the thigh, unite to the superficial absorbents and to those of the perinæum, and terminate in the superficial inguinal ganglions.

*Lumbar lymphatics.*—They arise from the posterior and lateral parts of the vertebral column, descend above the iliac crest, and terminate in the superficial inguinal ganglions.

*Lymphatics of the lower half of the abdominal parietes.*—Their roots form a plexus on the anterior face of the abdomen, from the umbilicus to the pubis, and unite inferiorly in several trunks, which pass to the superficial inguinal ganglions.

*Lymphatics of the perinæum, scrotum, and penis.*—They also terminate in the superficial inguinal gan-

glions. Those of the scrotum are very numerous, unite at the inner part of the thigh with those of the perinæum and with those of the penis, which consist in two distinct fasciculi, situated on the sides of this organ, and a single vessel which follows its back. In the female, the lymphatics of the external labia and of the clitoris are arranged in the same manner.

#### 4. DEEP OBTURATOR, ISCHIATIC, AND GENITAL LYMPHATICS, &c.

*Obturator lymphatics.*—Arising in the obturator muscles, they pass through the obturator foramen, with the obturator artery, and terminate in the hypogastric ganglions.

*Ischiatic lymphatics.*—They follow the ischiatic artery, and terminate in the pelvis in the preceding ganglions.

*Glutæal lymphatics.*—Arising in the glutæi muscles, they pass through the great sciatic notch, and terminate in the hypogastric ganglions.

*Deep lymphatics of the penis and clitoris.*—They follow the internal pudic artery, and terminate like the preceding.

*Lymphatics of the testicle.*—They arise from the coats and substance of the testicle and epididymis, and unite in from six to twelve branches, ascend with the cord of the spermatic vessels, pass through the inguinal ring, and follow the spermatic artery to terminate in the lumbar ganglions.

*Lymphatics of the prostate and seminal vesicles.*—Blended partly with those of the bladder, terminating in the hypogastric ganglions.

*Uterine lymphatics.*—They arise on the surface and in the substance of the uterus; they are very large in the state of pregnancy, and unite to those which come from the vagina to go to the hypogastric ganglions; the highest unite to those of the ovary, which are very numerous, and terminate in the lumbar ganglions.



## 5. LYMPHATICS OF THE URINARY ORGANS.

*Lymphatics of the bladder.*—They are very numerous, follow the course of the vessels of this organ, and open into the hypogastric ganglions.

*Lymphatics of the kidneys.*—They arise deeply or superficially in the tissue of these organs, and form trunks, which unite near their fissure, and terminate in the lumbar ganglions on the sides of the aorta.

*Capsular lymphatics.*—They come from the renal capsules, and unite partly to those of the kidneys; some terminate on the right in the hepatic ganglions, and on the left in the splenic, pelvic, and abdominal ganglions.

## 6. LYMPHATICS OF THE PARIETES.

*Ilio-lumbar lymphatics.*—They arise in the bones and iliacus muscle, and go partly to the inferior lumbar ganglions and partly to the external iliac lymphatic plexus.

*Sacral lymphatics.*—Most of them arise in the fatty tissue surrounding the rectum; some emerge from the anterior sacral foramina; they terminate in the hypogastric ganglions; these last contribute to form the hypogastric lymphatic plexus, which is situated on the sides of the sacrum, and is composed by an interlacing of vessels and ganglions; it receives the obturator, glutæal, ischiatic, uterine lymphatics, &c., and communicates with the external iliac and lumbar lymphatic plexuses.

*Epigastric lymphatics.*—They arise from the anterior abdominal wall and abdominal muscles, and terminate in the external iliac plexus.

*Circumflex iliac lymphatics.*—Arising in the integuments of the sides of the belly, they go to the external iliac ganglions.

*Lumbar lymphatics.*—They arise in the quadratus lumborum, obliqui, and transversales abdominis muscles, and in the vertebral canal; attend the lumbar arteries, divide into several ganglions situated between

the transverse processes, and form in front of the vertebral column, by numerous anastomoses with each other and with other lymphatics, the *lumbar lymphatic plexus*.

#### 7. LYMPHATICS OF THE STOMACH AND INTESTINES.

*Lymphatics of the intestines.*—These are termed lacteals; they are very common in the small intestine, while but few are found in the large intestine. Their roots open on the inner face of the intestines: many arise in their tunics: they ramify infinitely on the surface of these organs, anastomose frequently, go to the mesenteric and mesocolic ganglions, and, after subdividing frequently, go to the origin of the thoracic canal.

*Lymphatics of the stomach.*—These are superficial and deep. Some arise on the great cul-de-sac of the stomach, descend on the left along the vasa brevia, and unite with the lymphatics of the spleen; others follow the small curve of the stomach, divide in the adjacent ganglions, and then go to the right to unite with the inferior lymphatics of the liver, below its lobule; they then descend with them behind the pancreas, and come to the roots of the thoracic canal. The third kind descend on the two surfaces of the stomach towards the ganglions situated along its great curve, unite in some trunks near the pylorus, descend first on the pancreas, and then behind it, and divide into the ganglions which surround the cœliac and superior mesenteric arteries.

*Lymphatics of the great epiploon.*—These are few in number, and unite with the preceding in the ganglions of the great curve of the stomach.

#### 8. LYMPHATICS OF THE SPLEEN, PANCREAS, AND LIVER.

*Lymphatics of the spleen.*—They arise from the surface and tissue of this organ by many branches, which unite near the fissure in some trunks, which anastomose around the splenic vessels, pass under the pan-

creas, and unite with the inferior lymphatics of the liver.

*Lymphatics of the pancreas.*—They arise from this gland, and unite with those of the spleen and stomach.

*Lymphatics of the liver.*—These are very numerous. On the right lobe they are united in four fasciculi; the first is formed by the lymphatics which arise between the layers of the suspensory ligament, and unite in two or three trunks, enter the chest near the xiphoid cartilage, pass through some ganglions, and open into the thoracic canal near the left internal jugular vein. The second arises near the circumference and on the right of the same lobe, passes through the right lateral ligament of the liver, and divides into two layers of vessels: the superior ascend into the chest, and then go to the abdomen with the aorta, to terminate in the ganglions which are near; the others, the inferior, glide along the last ribs to the costo-vertebral articulations, where they unite with the intercostal lymphatics and open into the thoracic canal. The third fasciculus, the roots of which are distributed on the centre of the right lobe, unites partially to the preceding and to the posterior part of the liver. Some trunks go to the chest, and open into the thoracic canal. Finally, the fourth fasciculus comes from the anterior part of the right lobe. A part of its vessels unite with those of the first fasciculus, others join its deep vessels in the fissure of the liver. On the left lobe of the liver the superficial lymphatics are collected in three fasciculi. Those of the first unite in the suspensory ligament with those of the first fasciculus of the right lobe; those of the second arise on all the surface of the left lobe, and near the left lateral ligament divide into two parts; the inferior terminate in some ganglions, where they meet the lymphatics of the stomach and lower face of the liver; the superior unite with the lymphatics of the spleen. Finally, the vessels of the third fasciculus arise from the posterior part of the

left lobe, and terminate in the ganglions of the small curve of the stomach.

*Superficial lymphatics of the lower face of the liver.*—Some arise between the circumference of the liver and the gall-bladder, divide in the ganglions which surround the vena cava and the aorta; others come from the surface of the gall-bladder, and terminate in the ganglions behind the duodenum; finally, others arise in the left lobe and lobule, and unite with the preceding and the deep-seated lymphatics.

*Deep lymphatics of the liver.*—They arise in the tissue of the liver, accompany the ramifications of its vessels, emerge with them from its fissure, and go to the ganglions of the small curve of the stomach and to those which surround the cœliac artery.

#### THORACIC DUCT.

It is situated in the chest, between the two layers of the posterior mediastinum: it extends from the second or third lumbar vertebra as far as the left subclavian vein: is subject to many varieties, receiving all the preceding lymphatics and many others; it commences on the body of the third lumbar vertebra by the successive union of five or six large branches; it traverses the aortic opening of the diaphragm, and presents in this place a considerable enlargement; it mounts afterward into the thorax across the pillars of the diaphragm, on the right side of the aorta, and on the left of the vena azygos. Towards the sixth dorsal vertebra it inclines to the left side, and passes behind the arch of the aorta. Having arrived at the seventh cervical vertebra, it curves inward and downward, passes behind the inferior thyroid artery and left internal jugular vein, and opens near this latter into the posterior part of the subclavian vein of the same side. Its opening is furnished on the inner side with two valves. The thoracic canal receives in the chest several vessels from the liver and ganglions which surround the cœliac artery.

*Intercostal lymphatic vessels.*—They arise from the external thoracic and intercostal muscles, pass through some ganglions, and unite, on the sides of the vertebral column, to other vessels coming from the vertebral canal and the muscles of the back. They form plexuses in front of the vertebral column, and open very obliquely into the thoracic canal. This canal also receives many twigs from the pleuræ, diaphragm, &c.

The second division of the lymphatics are those which terminate partly in the thoracic duct and partly in the larger veins; such are, 1st, The superficial and deep-seated lymphatic vessels of the lungs, the former of which pass to the ganglia placed around the bronchial tubes at their entry into the lungs; the latter, arising in the tissue of the lungs, and following the divisions of the veins, unite with the preceding in the bronchial ganglia, and again form new ganglia, from whence one principal trunk proceeds, which mounts on the trachea; others traverse different ganglia, and collect into two trunks, which open either into the thoracic duct, or internal jugular and left subclavian veins; 2d, The diaphragmatic, cardiac, and œsophageal lymphatics; the more important of these, the cardiac, follow the course of the coronary vessels, and unite into two principal trunks, one of which accompanies the right cardiac artery, inclines to the left side, and opens into the superior part of the thoracic canal; while the other passes obliquely between the aorta and pulmonary artery, traverses some small ganglia, and opens either into the thoracic duct or internal jugular vein; 3d, The superficial and deep-seated lymphatics of the thoracic extremities; the former, proceeding from the fingers, mount on the posterior surface of the fore-arm; at the elbow joint they pass forward and unite with those coming along the anterior part, and traverse in the fold of the arm two small ganglia; they afterward pass up the internal and anterior part of the arm, and terminate in the axillary ganglia; the latter, or deep-seated set, follow the bloodvessels, and open also into

the axillary ganglia; 4th, The lymphatic vessels, arising from the axillary ganglia, form, by their union, a lymphatic plexus, from whence proceed three or four trunks, which surround the axillary vein as far as its entry into the chest. Those of the left side collect into one or two trunks, which open, in part, into the corresponding subclavian vein, and in part into the thoracic duct. Those of the right side unite into a single short trunk, which lies on the right subclavian vein, and opens into the angle formed by the union of the internal jugular and right subclavian veins; 5th, The superficial and deep-seated lymphatics of the head and neck; the superficial set form a plexus which accompanies the sub-cutaneous veins of the neck, and open by two or three trunks on the left side into the thoracic duct, on the right into the large trunk on that side; the latter, or deep-seated set, follow the course of the bloodvessels, and open partly into the internal jugular and subclavian veins, and partly into the thoracic duct and great branch of the right side.

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## ORDER IV.

### SECRETORY APPARATUS.

The organs which secrete are termed glands. We shall describe them, first generally, and then in detail.

#### OF THE GLANDS GENERALLY.

The glands which compose this system are more or less rounded bodies, which have for a common character the separation by a special elaboration from the mass of the blood a liquid peculiar to each gland, and which, by the aid of canals, termed excretory ducts, is thrown off or preserved for some time in a species of reservoirs.

*General formation.*—The glands are situated ex-

clusively in the trunk. They vary much in size and form. They are irregularly rounded, some are flattened in one or more directions. *Structure*.—They are composed, 1. Of an external coat, which is sometimes cellular and sometimes fibrous: 2. Of a proper parenchyma or tissue. This differs in each gland. It however presents itself in three principal forms. Some of the glands are formed by the agglomeration of small lobules, which unite and form larger lobes. In some the glands are formed of lobes, which are separated by cellular tissue (as the salivary glands, the pancreas, and lachrymal glands); in others we find but little cellular tissue between them; they have a uniform granular appearance (as the liver and kidneys). Finally, the glands of the third kind (as the prostate and the amygdalæ) have a soft, and, as it were, pulpous parenchyma, without any appearance of granular grains or lobes. The testes and mammæ have a special structure, which prevents their being included in this classification.

3. The *excretory canals* are another essential element of the glands. These commence by very minute radicles in the tissue of the glands, probably in their final granulations. They then unite in twigs, branches, and trunks, which increase in size. These trunks finally open on the mucous membranes. In their course, which varies in length, they often present enlargements and reservoirs. The excretory canals are formed internally by a mucous membrane, and externally by a more or less dense layer of cellular tissue. The glands receive nerves, and many blood-vessels and lymphatics. *Vitality and functions*.—The glands have generally but little sensibility in the healthy state. Their function is termed *secretion*, and consists, as stated when defining these organs, in preparing particular fluids, the materials of which are furnished by the blood, and which are then poured forth on the mucous surface by the excretory canals. Their mode of elaboration is unknown.



## OF THE GLANDS.

The secretory apparatus is composed, 1. Of the lachrymal gland and passages; 2. Salivary glands; 3. Pancreas; 4. Liver; 5. Kidneys and appendages. It also includes the testicles and mammæ; but, as these latter organs belong more particularly to the generative function, we shall treat of them under that head. We generally include in the secretory apparatus the spleen, the functions of which are unknown.

## LACHRYMAL GLAND AND APPENDAGES.

This includes the lachrymal gland, which is the secreting organ of the tears, and the organs which serve for their excretion, viz., the caruncula lachrymalis, the lachrymal puncta and passages, the lachrymal sac, and the nasal canal.

## LACHRYMAL GLAND.

*Situation.*—At the superior external and anterior part of the orbit, in a depression of the frontal bone. *Volume.*—That of a small almond; elongated from before backward, flattened from above downward and from without inward. *Relations.*—Superiorly and on the outer side with the periosteum of the orbit; on the inner side and inferiorly with the globe of the eye and external rectus muscle; anteriorly with the border of the orbit; posteriorly with much cellular tissue and fat. *Organization.*—Formed of rounded, reddish-white granulations, which give rise to excretory canals; these unite and give origin to six or seven trunks, which open on the internal side of the superior eyelid. These granulations are united together by cellular tissue, and form lobules, the whole of which are enclosed by a fibro-cellular capsule. It receives an artery, vein, and nerve.

## CARUNCULA LACHRYMALIS.

*Situation*.—At the internal canthus, in front of the globe of the eye, behind the lachrymal puncta. *Form*.—That of a small reddish tubercle, pyramidal, the base turned posteriorly and inward, the apex forward and outward. *Organization*.—Composed of a mass of small mucous follicles, covered by the conjunctiva, which forms in front and on its outer side a semilunar fold, the remains of the *membrana nictitans*, so well developed in animals.

## LACHRYMAL PUNCTA AND DUCTS.

*Lachrymal puncta*.—These are two very narrow openings, one on each eyelid, always open, situated opposite each other, in the centre of a small tubercle observed at about a line and a half from the internal canthus; the inferior is turned upward, outward, and backward; the superior downward, outward, and backward. They are the orifices of the *lachrymal ducts*. These ducts are superior and inferior; the superior mounts at first vertically for about a line, and then turns downward and inward; the inferior descends at first nearly vertically, and afterward mounts a little inward to place itself on the side of the preceding; they both open at the middle and external part of the lachrymal sac. They are formed by a prolongation of the conjunctiva.

## LACHRYMAL SAC.

*Situation*.—At the internal canthus, in a groove formed by the os unguis and ascending process of the superior maxillary bone. *Form*.—That of a small membranous oval pouch, a little flattened from without inward, receiving the lachrymal ducts, and continuous with the nasal duct. *Relations*.—Anteriorly with the skin, orbicularis palpebrarum, and its tendon; posteriorly with the caruncula lachrymalis and conjunctiva; superiorly with the tendon of the orbicularis muscle; inferiorly with the nasal duct. *Organ-*

*ization*.—This sac is covered anteriorly by the conjunctiva, which is continuous in its cavity, and is formed externally by a fibrous membrane adhering to the border of the lachrymal groove.

#### NASAL DUCT.

This is a canal formed in the bones already mentioned, and lined by the mucous membrane of the lachrymal sac; this canal opens into the nasal fossa, beneath the inferior turbinated bone, by a narrow orifice, which is provided with a circular and membranous fold.

#### OF THE SALIVARY GLANDS.

Of these there are three: the parotid, sub-maxillary, and sub-lingual glands.

#### PAROTID GLAND.

It is larger than the other salivary glands. *Situation*.—In the deep cavity which exists on the sides of the face, between the posterior edge of the lower jaw, the external auditory foramen, and mastoid process of the temporal bone. *Extent*.—From above downward, and from the zygomatic arch as far as the angle of the lower jaw. *External surface*.—Broad, flattened, covered by some of the fibres of the platysma myoides and by the skin. *Anterior surface*.—Applied superiorly against the temporo-maxillary articulation; on the outer side, on the posterior border of the lower jaw; on the inner side, on the internal pterygoid muscle. *Posterior face*.—United by cellular tissue to the external auditory canal, to the mastoid aponeurosis, to the anterior border of the sterno-mastoid muscle, to the posterior belly of the digastricus, to the styloid process, and to the muscles which are attached to it; it is also in relation with the external carotid and temporal arteries and facial nerve. *Organization*.—The tissue of this gland is of a grayish-white colour, composed of granulations united into

lobules and lobes by condensed cellular tissue. Each granulation gives origin to an excretory duct; these ducts unite to form the duct of Steno. The latter is about a line in diameter, comes out from the antero-external part of the gland, and proceeds horizontally from behind forward, on the external face of the masseter muscle; it afterward turns on its anterior border, traverses perpendicularly the buccinator muscle, and opens into the mouth on a level with the second superior molar tooth. The duct of Steno is formed of two membranes; one exterior, white, thick, and resisting; the other interior, thin, and a mucous membrane. The parotid gland receives branches from the transverse facial and posterior auricular arteries; its nerves come from the facial and the inferior maxillary nerve, and from the cervical plexus.

#### SUB-MAXILLARY GLAND.

*Situation.*—On the inner side of the ramus and body of the inferior maxilla, between the two bellies of the digastricus. *Form.*—Irregularly ovoid, flattened on its three surfaces, bifurcated anteriorly. *Relations.*—On the outer side with the angle of the inferior maxilla and external pterygoid muscle; on the inner side with the digastricus and hypo-glossal nerve; superiorly with the mylo-hyoideus and sub-lingual gland; inferiorly with the platysma myoides and skin; posteriorly, by its posterior extremity, with the parotid gland; and anteriorly, by its anterior extremity, with the mylo-hyoideus muscle. *Organization.*—Similar to that of the parotid. Its excretory duct, termed the duct of Wharton, arises, like that of Steno, by delicate roots in the granulations of the gland; it comes out from its deepest part, passes horizontally forward and inward between the genio-glossus and sub-lingual gland, and, reaching the side of the frenum of the tongue, it opens there by a narrow orifice placed on the middle of a small and slightly prominent tubercle. It is covered by a prolongation of the mucous membrane of the mouth. Its arteries come from the fa-

cial and lingual, and its nerves from the lingual and inferior dental nerve, and sub-maxillary ganglion.

#### SUB-LINGUAL GLAND.

*Situation.*—In the thickness of the lower wall of the mouth, beneath the anterior part of the tongue. *Form.*—Elongated from before backward, flattened transversely, directed horizontally forward and inward. *Relations.*—Inferiorly with the mylo-hyoideus; superiorly with the mucous membrane of the mouth; on the inner side with the genio-glossus; anteriorly with the body of the inferior maxilla; posteriorly with the sub-maxillary gland. *Organization.*—Similar to the other salivary glands; provided with many excretory ducts, some of which pierce separately the mucous membrane of the mouth; others open on the lateral parts of the frenum of the tongue. The arteries of the sub-lingual gland come from the facial and sub-lingual, and its nerves from the inferior maxillary and hypo-glossal.

#### PANCREAS.

*Situation.*—In the abdomen, at the posterior part of the epigastric region, on the vertebral column, between the three portions of the duodenum, behind the stomach, and on the right of the spleen. *Form.*—Irregular, elongated transversely, flattened from before backward, divided into two faces, two borders, and two extremities. *Anterior face.*—Covered by the superior fold of the transverse mesocolon, the stomach, and first portion of the duodenum. *Posterior face.*—Presenting a groove for the splenic vessels, in relation with the superior mesenteric vessels, aorta, and vena cava. *Superior border.*—Traversed by the celiac artery; the *inferior border*, applied on the third portion of the duodenum. *Left extremity.*—Very thin, and prolonged beneath the spleen. *Right extremity.*—Rounded and thicker, termed the head of the pancreas, applied against the second portion of the duodenum. Beneath this extremity we generally

perceive a small glandular body, termed the lesser pancreas. *Organization.*—The tissue of the pancreas is analogous to the salivary glands, of a grayish-white colour, composed of lobes, lobules, and granulations, from which the roots of the excretory duct come off. This duct is placed in the thickness of the gland, directed from left to right, gradually augments in volume, and takes a serpentine course towards the duodenum; it receives the duct of the lesser pancreas, and opens into this intestine at the lower part of its second curve, sometimes by a distinct orifice, at other times by one in common with the ductus choledochus. The arteries of the pancreas are very small; its nerves come from the solar plexus.

#### LIVER.

*Situation.*—In the right hypochondrium, which it occupies entirely, and in the right part of the epigastrium, beneath the diaphragm, above the stomach, the lesser omentum, the duodenum, the arch of the colon, the gall-bladder, and right kidney; in front of the aorta and inferior vena cava, and behind the anterior parietes of the abdomen, varying in weight from two to five pounds. *Form.*—Irregular, elongated transversely, flattened from above downward, very thick posteriorly, thin anteriorly, of a purplish-brown colour. *Superior face.*—Convex in its entire extent, contiguous to the diaphragm, divided by a fold of the peritoneum, termed the *suspensory ligament*, into two unequal portions. *Inferior face.*—Irregularly concave and convex, presenting from right to left, 1. A superficial depression, which corresponds to the superior face of the stomach; 2. The longitudinal fissure, more or less deep, receiving in the fœtus anteriorly the umbilical vein, and posteriorly the ductus venosus; but in the adult it is occupied by these vessels, which are obliterated, and have become fibrous cords; 3. The transverse fissure, or fissure of the vena porta, following the great diameter of the liver, cutting the former at right angles, occupying the mid-

dle third of this organ, and lodging the sinus of the vena porta, the hepatic artery, nervous filaments, and lymphatic vessels; 4. A groove for the inferior vena cava, which is very short, and is situated posteriorly, near the posterior border of the liver; 5. The lobulus Spigelii, of an irregular form, situated behind the transverse groove of the liver, in front of the vertebral column, between the inferior vena cava and œsophagus; 6. The *lobulus caudatus*, less than the preceding, placed in front of the middle part of the transverse fissure, stretching downward from the middle of the great right lobe to the lobulus Spigelii; 7. Finally, on the right side, two superficial depressions; one anterior, corresponding to the right extremity of the transverse colon, the other posterior, to the right kidney and surrenal capsule of the same side; 8. At the under surface of the right lobe, between the gall-bladder and round ligament, the *lobulus quadratus*. *Anterior edge*.—Thin, convex, applied against the base of the thorax, interrupted by two fissures, the one formed by the passage of the umbilical vein, the other corresponding to the bottom of the gall-bladder. *Posterior edge*.—Thick, rounded, fixed in the middle to the phrenic centre by dense cellular tissue; by its sides to the diaphragm, by two folds of the peritoneum, termed the triangular ligaments. *Organization*.—The liver is formed by envelopes, bloodvessels, lymphatics, nerves, a special tissue, and an excretory apparatus. 1. Its serous envelope is thin, smooth, and transparent, and is formed by the peritoneum, which does not cover its posterior border, the two fissures of its inferior surface, that of the vena cava, nor the depression which lodges the gall-bladder. 2. Its cellular envelope is very extensive; it covers all its surfaces, and follows the branches and ramifications of the vena porta, hepatic artery, and hepatic duct, under the name of the capsule of Glisson. 3. The bloodvessels of the liver are the hepatic artery, the vena porta, and the hepatic veins. In the fœtus the blood is brought to the liver by the umbilical vein. Its lymphatics are very numerous;



its nerves come from the pneumogastric and diaphragmatic nerves, and the hepatic plexus. 4. The parenchyma of the liver is of a brownish colour, verging on yellow, formed of an immense quantity of granulations of a dirty red colour, in which the branches of the vena porta and hepatic artery terminate, and from whence the roots of the biliary ducts and hepatic veins, and the deep lymphatic vessels, proceed.

#### THE EXCRETORY APPARATUS OF THE BILE.

1. *Hepatic duct*.—It arises by a great number of delicate roots, which unite successively into larger branches, accompanied by the divisions of the vena porta and hepatic artery, and form two principal trunks, one for the left lobe, the other for the right, which proceed outward through the transverse fissure, and unite at right angles. The hepatic duct, which results from it, is about an inch and a half in length, and one line and a half in diameter; it descends obliquely inward, between the two folds of the gastro-hepatic epiploon, in front of the vena porta, on the left of the neck of the gall-bladder, and unites with the cystic duct.

2. *Gall-bladder*.—*Situation*.—In a superficial depression on the inferior face of the right lobe. *Form*.—That of a membranous pyriform sac, its large extremity directed forward, to the right, and downward; its summit backward, upward, and to the left. Its body adheres superiorly to the substance of the liver by dense cellular tissue; it is free inferiorly, covered by the peritoneum, and applied to the pylorus, duodenum, and right extremity of the arch of the colon; its fundus, or bottom, is rounded, and corresponds often to the parietes of the abdomen and to the outer side of the rectus abdominis muscle; its neck is narrow, and continuous with the cystic duct. The inner surface of the gall-bladder is corrugated, reticulated, and has more or less of a greenish tint.

3. *Cystic duct*.—Forming a continuation with the

neck of the gall-bladder, situated in the gastro-hepatic epiploon; about an inch and a half in length, directed inward, backward, and a little upward; it lies in apposition with the hepatic duct for a short way, and afterward unites to it, forming the

4. *Ductus communis choledochus*.—Formed by the junction of the cystic and hepatic, from three to three and a half inches long, situated between the two folds of the gastro-hepatic epiploon, in front of the vena porta, and beneath the hepatic artery; it descends behind the right extremity of the pancreas and second portion of the duodenum; opens with the pancreatic duct, or proceeds along its side, obliquely into the duodenum near its last curve. All the excretory passages of the bile are formed externally by a membrane with white and longitudinal fibres, and internally by a very thin mucous membrane.

#### SPLEEN.

*Situation*.—In the left hypochondrium, beneath the diaphragm, above the descending colon, between the cartilages of the false ribs and great end of the stomach. *Form*.—Elongated from before backward and from above downward, flattened from without inward. The *external face* is applied against the diaphragm, in relation with the ninth, tenth, and eleventh left ribs; its *internal face* is divided into two parts by a fissure, where the vessels enter. Its circumference is notched in many places, and in relation superiorly with the diaphragmatic aponeurosis; inferiorly with the kidney and left renal capsule; posteriorly with the pancreas; anteriorly with the parietes of the thorax. *Organization*.—Its parenchyma is soft, spongy, of a dirty red colour, enveloped by a serous and fibrous membrane, consisting of small grayish semi-transparent bodies of the size of a pin's head; it is supplied with a great quantity of blood, which seems contained in small cells formed by the prolongations of the fibrous tunic of the organ. The former is thin, smooth, and transparent,

and is formed by the peritoneum, which covers all the outer face of the spleen except the base of the fissure. The latter is of a grayish-white, dense, resisting, and attached to the preceding by its outer face, and giving off from the internal mammary prolongations the parenchyma of the spleen.

#### ORGANS FOR THE SECRETION AND EXCRETION OF THE URINE.

Under this head are included the renal capsules, kidneys, ureter, and bladder.

#### RENAL CAPSULES.

*Situation.*—In the abdomen, above the kidneys.  
*Form.*—Resembling somewhat a cocked hat, curved from above downward, hollowed, and ovoid in the adult, prismatic and granulated in the fœtus, where it is found of considerable size, of a yellowish-brown colour, more or less shaded with red. *Posterior face.*—In relation with the diaphragm and superior part of the psoas muscle. *Anterior face.*—Covered on the right side by the inferior vena cava and duodenum, and on the left by the spleen and pancreas. *Inferior face.*—Applied on the superior extremity of the kidney. *Organization.*—These bodies contain a narrow, transverse, and triangular cavity, presenting at its lower part an eminence somewhat in the form of a crest; this cavity contains a viscid, rosy-coloured liquid in the fœtus, which becomes brown in old men; the walls of the cavity are thick, and formed of small granulations. The capsular arteries come from the aorta, the inferior diaphragmatic, and the renal; their veins go on the right to the vena cava, on the left to the renal vein; their nerves come from the renal plexuses.

#### KIDNEYS.

*Situation.*—In the deep part of the lumbar region, on the sides of the vertebral column, on a level with

the two last dorsal vertebræ and two first lumbar.—*Anterior face*.—Convex; in relation, that of the right side with the duodenum and ascending colon; that of the left with the descending colon. *Posterior face*.—Nearly plane, separated from the diaphragm and aponeurosis of the transversalis muscle by a thick layer of fat. The internal border presents the fissure for the entry of the vessels. The external border is convex, thick, and rounded, and turned backward. The upper extremity is thick and rounded, and embraced by the renal capsule. The lower extremity is thin and elongated. *Organization*.—The kidney is formed by vessels and nerves, a cellular envelope, and the parenchyma. The renal artery comes from the aorta, and its veins terminate in the vena cava; its nerves come from the renal plexus. The cellular envelope is thin and transparent; it covers the surface of the kidneys, penetrates into its fissure, and is reflected on the loose surface of the pelvis. The parenchyma is composed of two substances, an exterior, termed the *cortical*, and an internal, the *tubular*. The former is of a reddish-brown colour, forms around the latter a layer of about one or two lines in thickness, and sends inward prolongations into the fasciculi of the tubular portion. This part appears formed of small granulations, in which the capillary arteries and veins terminate. The latter, or tubular substance, is of a pale red colour, dense, and resistant, forming twelve to eighteen conical fasciculi, enveloped by the cortical substance except at their summit. The base of these cones is turned towards the periphery, and united to the cortical substance; the summit is directed towards the pelvis of the kidney, and, from their form, they have been termed the *mamellated* portions. Each cone is formed of a number of converging canals, continuous with the vessels of the cortical substance, and opening into the calices by very narrow orifices.

The *calices* are small membranous ducts, from six to twelve in number, which vary in diameter, and embrace on one side the circumference of the mam-

ellated portions, and open on the other side into the pelvis.

The *pelvis* is a small membranous reservoir, placed at the posterior part of the fissure of the kidney, behind the renal artery and vein; it is irregularly oval, elongated from above downward, flattened from before backward, receiving the orifices of the calices, and continuous inferiorly with the ureter.

The *ureter* is a long membranous duct, of the diameter of a crow-quill or less, extending from the pelvis to the base of the bladder. *Course*.—It commences in the fissure of the kidney by a hollowed portion, termed the *infundibulum*; it descends at first obliquely inward as far as the sacro-iliac articulation; it proceeds then a little forward, but still downward, and, arriving at the postero-inferior surface of the bladder, it passes between its muscular and mucous tunics; it is directed inward and forward for about an inch, and then opens at the posterior angle of the vesical trigone by a narrow oblique orifice. *Relations*.—1st, Posteriorly and from above downward with the psoas major, primitive iliac, and hypogastric vessels; 2d, Anteriorly with the peritoneum, spermatic artery, and, in man, with the vas deferens. The calices, pelvis, and ureters are formed externally by a thick and opaque white membrane, and internally by a mucous, thin, white, and semi-transparent membrane.

#### BLADDER.

*General conformation*.—*Situation*.—At the anterior part of the cavity of the pelvis, behind the pubes, in front of the rectum in man, and of the uterus in woman. Its dimensions vary. *Form*.—In infants, that of a membranous cylindrical reservoir; in man, conoid; in woman, rounded. *Direction*.—Nearly vertical, a little oblique from above downward and from before backward; its summit inclines a little to the left side. The external surface of the bladder is divided into six regions; the *superior region*, or *fundus*, is deprived

of the peritoneum in its anterior part; is generally contiguous to the inferior convolutions of the small intestines, adhering to the urachus, which is a species of fibrous cord mounting between the peritoneum and linea alba as far as the umbilicus, where it terminates. *Inferior region.*—More extensive than the superior, broader posteriorly. In man it is bounded anteriorly by the base of the prostate gland; united posteriorly, by more or less dense cellular tissue, to the vesiculæ seminales and termination of the vas deferens, and between the two vesiculæ seminales it rests on the rectum; on the outer side of the vesiculæ seminales it corresponds to the levator ani; in the female it rests on the vagina, and corresponds outward also to the levator ani. Inferiorly it presents in its middle portion a triangular space termed the *trigone*; the two posterior angles of this triangle present the orifices of the ureters, and its anterior angle corresponds to the origin of the urethra. From the anterior part of the inferior region proceeds the neck of the bladder, which represents in man a species of truncated cone, nearly horizontal in the adult, directed obliquely forward and downward in the infant, embraced anteriorly by the prostate gland, resting posteriorly on the rectum; in woman it is shorter, and rests on the vagina. *Anterior region.*—Deprived of the peritoneum, it corresponds to the posterior surface of the body of the pubes, and when the bladder is distended by urine, to the anterior wall of the abdomen; from its inferior part the anterior ligament of the bladder proceeds, passing horizontally behind the symphysis pubis, to which it is attached. The posterior surface is smooth, and contiguous to the rectum in the male, and to the uterus in the female. The lateral regions are narrower superiorly than inferiorly, and present the umbilical arteries and the vasa deferentia. *Interior surface.*—In a state of vacuity, is covered with numerous irregular wrinkles or folds, crossing in different directions, and separated by depressions of greater or less extent; the anterior angle corresponds to the origin of the urethra, the ori-

fice of which, termed the neck of the bladder, represents a sort of crescent, the contour of which is thick, and embraces a small tubercle, formed by a prominent fold of the mucous membrane, and terminating in the *caput gallinaceum*. *Organization*.—1st, The serous tunic or peritoneum covers only the superior, posterior, and lateral regions; it is united to the muscular layer by loose cellular tissue. 2d, The muscular tunic is whitish, thick towards the fundus of the bladder, between the vesiculæ seminales and the superior region, but extremely thin in the other regions; those muscular fibres which are situated on the median line seem to mount from the prostate and neck of the bladder towards the urachus; others arise from the lateral parts of the neck, and cross at the superior region. The neck of the bladder is surrounded by a separate muscle, which anatomists have termed the sphincter; the fleshy fibres lie under the base of the prostate gland, and surround the beginning of the urethra, and are resting on a layer of whitish tissue, apparently fibrous, firm, and elastic, and which is prolonged, gradually becoming thinner, as far as the base of the trigone. The mucous membrane is thin and whitish, particularly so near the neck of the bladder; in the rest of its extent it is frequently of a slight rosy colour. The arteries of the bladder arise from the hypogastric and its branches; its veins go to the hypogastric venous plexus; its nerves come from the sciatic and hypogastric plexuses.

P p



## CLASS III.

## GENITAL SYSTEM.

## ORDER I.

## MALE GENITAL ORGANS.

THIS system is composed of the testicles and their appendages, the seminal vesicles, and penis.

## TESTICLES AND APPENDAGES.

The envelopes of the testicles are five: they are, reckoning from without inward, the scrotum, dartos, erythroid tunic or cremaster muscle, fibrous tunic, and vaginal tunic.

1st, *The scrotum, or cutaneous envelope.*—It is formed by a prolongation of the skin of the internal part of the thighs, perinæum, and penis; its surface is brownish, corrugated, and traversed from before backward, from the root of the penis as far as the anterior part of the anus, by a well-marked line termed the raphe; the inner surface is united to the dartos by compact cellular tissue. The chorion of the scrotum is very thin, and contains a considerable quantity of sebaceous follicles.

2d, *The dartos.*—These are two membranes of a rosy colour, entirely cellular, on which a great number of vessels ramify, and fixed to the rami of the ischium and pubes; they meet in the middle, and thus form the septum which separates the testicles. The outer face adheres to the scrotum; the internal surface is applied on the fibrous tunic of these organs, and on the extremity of the cremaster muscle.

3d, *Cremaster muscle.*—This has been already described. See page 170.

4th, *The fibrous tunic* is thin, transparent, and little resistant; it forms a small elongated sac, broad

below, where it contains the testicle and epididymis; mounting upward, it forms a sort of sheath for the spermatic cord; inferiorly, some of its fibres are intimately united with those of the pillars of the ring.

5th, *Tunica vaginalis*.—This is a serous membrane, and constitutes, like those membranes, a sac without an opening; it covers the whole internal surface of the fibrous tunic, and is reflected on the epididymis and testicle, which it covers completely, except on a level with its superior border. Its external surface adheres to the fibrous tunic, the epididymis, and the albugineous membrane; its inner surface is smooth, polished, and moistened by serum. In young subjects, before the testicles have descended, this tunic is manifestly continuous with the peritoneum.

#### TESTICLES.

Of these there are two, a right and a left; they are situated in the scrotum. *Form*.—That of an ovoid, compressed transversely, presenting two lateral surfaces slightly convex; an inferior border, inclined forward; a superior, turned backward, and in apposition with the epididymis; an anterior extremity looking upward, and a posterior downward. *Organization*.—The *membrana albuginea*, the proper tunic of the testicle, is analogous to the sclerotica; it is of an opaque white, and of a fibrous tisse; its external surface is covered by the tunica vaginalis; the internal is in apposition with the parenchyma of the testicle, and sends inward delicate prolongations, which are directed towards the superior part of this organ, forming triangular spaces which contain the seminal vessels. On the inner side of this membrane or tunic we observe the *corpus highmorianum*, an elongated prominence, at the superior border of the testicle, across which the principal trunks of the seminal vessels pass obliquely towards the epididymis. The parenchyma of the testicle is soft, pulpy, of a yellowish-gray colour, formed of an immense quantity of delicate, tortuous filaments, loosely united to each other;

according to the experiments of Munro they do not exceed the 1-200th part of an inch in diameter. These filaments, termed the seminal ducts, are all directed towards the superior border of the testicle, and here form some considerable trunks, from ten to twelve, sometimes from twenty to thirty in number, which traverse the corpus highmorianum; on a level, and a little beneath the head of the epididymis, they dilate a little, and give origin to the duct which forms the epididymis. The testicles receive the spermatic arteries, and give rise to the spermatic veins. No nerve can be traced to them.

#### EPIDIDYMIS.

*Situation.*—Along the upper edge of the testicle.  
*Form.*—That of an oblong, vermiform body, swelled at its extremities, thin in its middle portion, and flattened from above downward. Its superior part, or head, arises from the corresponding part of the testicle, where it receives the *vasa efferentia*; its inferior part, or tail, adheres to the testicle, and is continuous with the *vas deferens*; its middle portion is only united to the testicle by the tunica vaginalis. *Organization.*—The epididymis is formed by the union of the seminal vessels: it is a very thin and tortuous passage, having parietes which are very thick in proportion to its cavity, which is small.

#### SPERMATIC CORD.

This cord is formed by the spermatic artery and veins, the lymphatics, nervous twigs, and vas deferens; these parts are united by a loose cellular tissue, and are surrounded by membranous sheaths; it ascends almost vertically from the upper edge of the testicle to the symphysis pubis, goes outward and upward, and enters the abdomen through the inguinal ring, crossing the epigastric artery. There the organs which compose it separate.

## VAS DEFERENS.

This arises from the tail of the epididymis, mounts along its superior surface, afterward goes along the posterior part of the spermatic cord as far as the inguinal ring; having entered the abdomen, it leaves the other vessels of the cord, descends backward and inward on the sides of the bladder; beneath the infero-posterior region of this viscus, it approaches that of the opposite side, changes its direction, and passes nearly horizontally from behind forward and from without inward, along the internal side of the vesiculæ seminales; at the base of the prostate gland it receives the excretory duct of the vesiculæ seminales, and gives origin to the ejaculatory duct. Its colour is white; its consistence nearly cartilaginous; it is thin at its origin, but enlarges on passing through the inguinal ring; its cavity is extremely small.

## VESICULÆ SEMINALES.

*Situation.*—Beneath the bladder, in front of the insertion of the ureters, above the rectum, on the outer side of the vas deferens, on the inner side of the levatores ani. *Form.*—That of two membranous reservoirs, about two inches and a half long, and six or seven inches broad, directed obliquely inward and a little downward; the posterior extremity is rounded and broad; the anterior is elongated and narrow, and terminates in a narrow canal which opens into the vas deferens. The interior of the vesicles presents a tortuous canal, in which open laterally the appendages, which vary in number from fourteen to sixteen, and which form prominences, seen externally. *Organization.*—The seminal vesicles are composed externally by a dense and whitish membrane, and internally by a very fine, almost white, and slightly corrugated mucous membrane.

## PROSTATE GLAND.

*Situation.*—In front of the neck of the bladder, between the rectum and symphysis pubis. *Form.*—That of a truncated cone, flattened from above downward, notched at its base, which is posteriorly. *Superior face.*—Covered by the inferior ligament of the bladder. *Inferior face.*—Resting upon the rectum. *Base.*—Embraces the neck of the bladder. *Summit.*—Terminating in the membranous portion of the urethra. This gland is traversed near its upper surface by a canal, which lodges the commencement of the urethra, and near its inferior surface by the ejaculatory ducts. It consists of two lateral lobes, the sides of which are rounded and covered by portions of the levatores ani; a third lobe has been described, placed posteriorly in respect to the urethra, between the lateral lobes. *Organization.*—The prostate is of a grayish-white colour, dense, and very firm to the touch, formed of numerous follicles, which give origin to the excretory ducts, from ten to fifteen in number, opening into the urethra on the sides and surface of the verumontanum.

## COWPER'S GLANDS.

These are two small, oblong, and rounded glandular bodies, of the size of a very small pea, of a reddish colour, and of a tissue analogous to that of the salivary glands; they are situated in front of the prostate gland, on the sides of the canal of the urethra, and above the accelerator urinæ muscles; each has an excretory duct about six lines long, which passes obliquely inward and forward, and opens in front of the verumontanum.

## EJACULATORY DUCTS.

Formed by the union of the excretory ducts of the vesiculæ seminales and vas deferens; they are conical, about an inch long, traverse obliquely the prostate gland in apposition with one another, and open

into the urethra by two oblong orifices, placed at the lateral and anterior parts of the verumontanum.

#### PENIS.

It is situated at the lower anterior and middle part of the abdomen, below and before the symphysis pubis. *Form.*—Elongated, cylindrical, a little flattened from before backward. *Posterior extremity.*—Fixed to the rami of the pubes; the *anterior* is formed by the glans and prepuce. *Organization.*—The principal parts entering into the composition of this organ are, 1st, The skin. This is thin, containing many mucous follicles; it is united to the cavernous body by a layer of loose cellular tissue, and is continuous with the integuments of the scrotum and pubis. At the end of the penis it forms a prolongation, termed the prepuce; this latter part consists of two membranes, the inner of which is the mucous, and lies in contact with the glans penis; it is reflected on the surface of this latter; the skin forms the frenum. 2d, The *corpus cavernosum*.—Situated on the lateral parts of the penis, and forms nearly two thirds of its volume. *Form.*—Elongated, concave inferiorly, convex superiorly, extending from the internal anterior part of the tuberosities of the ischium as far as the glans penis. The *superior face* presents a superficial groove for the dorsal artery of the penis and veins, gives attachment posteriorly to the suspensory ligament of this organ, being a fibrous fasciculus attached to the inferior part of the symphysis pubis. *Inferior face.*—Marked by a broad deep groove for the superior side of the canal of the urethra, to which it is united by compact cellular tissue. *Anteriorly* it is united to the base of the glans, and presents a truncated extremity. *Posterior extremity.*—It is formed by two roots, fixed to the internal border of the ramus of the ischium and pubes, commencing in front of the sciatic tuberosity, uniting at the inferior part of the symphysis pubis, and separated by the canal of the urethra. *Organization.*—The *corpus cavernosum* is formed by a

fibrous envelope and by a spongy tissue. Its fibrous tunic is generally very thick and resisting, of an opaque white, formed of longitudinal fibres, which cross posteriorly with the periosteum of the bones of the ilium. The cavity of this membrane is divided into two lateral halves by a middle septum, which is prolonged from the symphysis pubis as far as the posterior part of the anterior third of the corpus cavernosum. Its spongy tissue, enveloped by the preceding membrane, appears to be a very complex network of arterial and venous vessels, and small fibrous plates, which latter form numerous cells, communicating together and with the bloodvessels, and always contain a greater or less quantity of blood. The cavernous arteries come from the internal pudic; its veins go to the vesical veins. 3d, *The urethra*.—Extending from the neck of the bladder as far as the extremity of the penis. *Form*.—That of a canal, from nine to twelve inches in length. *Course*.—At its origin it proceeds obliquely forward and downward, and traverses the prostate gland; passing through a circular aperture in the triangular ligament of the bladder, it afterward arrives beneath the symphysis pubis, mounts in front of it between the two roots of the corpus cavernosum, and descends in the groove in the inferior surface of this latter as far as the summit of the glans penis, where it opens by an elongated orifice. It is generally divided into three portions; 1st, *The prostatic portion*, which is from fifteen to eighteen lines long, is situated in the thickness of the prostate gland. 2d, *The membranous portion* is thin, narrow, from eight to ten lines long, and united to the rectum inferiorly and posteriorly, and anteriorly approaches the inferior part of the symphysis pubis. 3d, *The spongy portion* commences posteriorly by the bulb of the urethra, which is placed beneath the angle of union of the roots of the corpus cavernosum; it is situated superiorly in the groove of the corpus cavernosum, and is covered inferiorly by the skin; anteriorly it expands in order to form the glans penis. The cavity of the urethra



has not the same breadth in its whole extent; rather broad at its origin, it contracts and dilates anew in the centre of the prostate gland; it becomes narrower in the membranous portion than in the rest of the canal; its breadth is very nearly equal in the spongy portion, except towards its extremity, where it dilates, and is termed the fossa navicularis. The interior of the canal presents two central and white lines, one superior, the other inferior. Posteriorly and inferiorly we observe the verumontanum or caput Gallinaginis, a rounded prominence, which is an inch long, and is continuous posteriorly with a small prominent fold of the mucous membrane; the orifices of the ejaculatory ducts open at its sides, those of the prostate gland on its surface, and those of Cowper's glands in front of it. *Organization.*—The urethra is formed by a mucous membrane, a cellular membrane, and spongy tissue. The mucous membrane is very fine, continuous with that which covers the glans penis and which lines the bladder; it is of a clear red at the orifice of the urethra, it becomes pale and whitish in the rest of its extent; a great number of small foramina are observed opening on its surface, which form so many lacunæ, commencing at the bulb, and becoming more numerous towards the fossa navicularis. The cellular membrane arises near the neck of the bladder, and separates the mucous membrane from the tissue of the prostate gland; on the membranous part of the urethra it is denser, and is fortified by the fibres of the muscles of the anal and genital regions. The spongy tissue surrounds the three anterior fourths of its length; rather thick at the bulb, it forms a cylindrical layer as far as the glans penis, where it enlarges to form this part. The arteries of the urethra come from the internal pudic; its veins follow the course of the arteries; its nerves come from the pudic and inferior glutæal nerves.

## GLANS.

The glans, formed by a fold of the urethra, terminates the penis, and has the form of a cone, and is a little flattened from above downward. Its summit presents the orifice of the urethra; its base embraces the extremity of the corpus cavernosum, and is bounded by a prominent edge, termed the corona glandis. Below the urethra the corona is interrupted by a little groove occupied by the frenum of the penis.

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## ORDER II.

## FEMALE GENITAL ORGANS.

These parts consist of the vulva and vagina, the uterus and ovaries, and the mammæ. The vulva is the name given to the assemblage of the external parts of generation in the female. It includes the mons Veneris, the external labia, the clitoris, the internal labia or nymphæ, the meatus urinarius, and the urethra, the orifice of the vagina with the hymen, or carunculæ myrtiformes, and finally the vestibule, the fossa navicularis, and the fourchette. *Mons Veneris*.—A rounded, more or less prominent and hairy eminence, situated in front of the pubis, formed by a mass of fat. The *greater labia*.—These are two membranous folds, elongated from before backward, flattened transversely, and situated on each side of the vulva. Their external surface is contiguous to the superior internal parts of the thighs. They are formed externally by the skin, internally by the mucous membrane, between which is a considerable quantity of loose cellular tissue. The *clitoris*, a small elongated tubercle, placed at the upper and middle part of the vulva; it presents much analogy to the penis in the male; its free extremity resem-

bling the glans penis, and also surrounded by a fold of the mucous membrane similar to the prepuce. It also has a corpus cavernosum, of a spongy nature, fixed by two roots to the rami of the ischium, and receiving many branches of vessels and nerves. The *lesser labia*, or *nymphæ*, resemble two membranous crescents, extending from the prepuce of the clitoris to nearly the middle of the orifice of the vagina; on the outer side they are contiguous to the internal surface of the great labia; on the inner side they correspond to the opening of the vagina and to the meatus urinarius. They are formed by two folds of the mucous membrane of the vulva, between which is a thin layer of erectile and spongy tissue. The *meatus urinarius* and *urethra*.—The meatus urinarius is placed at the bottom of the vestibule, above the opening of the vagina; it is the orifice of the canal of the urethra, which is about an inch long, very broad at its origin, and descends obliquely forward in describing a slight curve, the concavity of which is turned upward; it is in relation inferiorly and on the sides with the superior wall of the vagina; superiorly with the inferior ligament of the bladder, the symphysis pubis, and corpus cavernosum of the clitoris. The mucous membrane which covers it is reddish, more or less folded, and is enveloped by a thin layer of spongy tissue. The orifice of the vagina is situated at the inferior part of the vulva, below the meatus urinarius, and is occupied by the hymen, or the *carunculæ myrtiformes*. The hymen is a fold of the mucous membrane of the vulva, which closes but incompletely the orifice of the vagina, and is of semi-lunar, parabolic, or circular form. The *carunculæ myrtiformes* are small tubercles, varying in number, and resulting from the rupture of the hymen. The triangular space comprised between the superior parts of the great labia is termed the *vestibulum*; the commissure of these parts, the *fourchette*; and the transverse depression, placed between the orifice of the vagina and the latter, the *fossa navicularis*. *Mucous membrane of the vulva*.—This membrane, of a

red, vermilion, or livid colour, extends to all parts forming the vulva. It lines the inner face of the external labia, and folds to form the internal; it surrounds the clitoris, penetrates into the meatus urinaris and vagina, forming, at the orifice of this passage, the hymen, or carunculæ myrtiformes. It is loosely united to the subjacent parts, and is covered by a very thin epidermis, which rests on a great number of mucous follicles.

*Vagina.*—*Situation.*—In the pelvis, between the bladder and rectum. *Extent.*—From the neck of the uterus to the vulva. *Form.*—That of a membranous canal, cylindrical, compressed from before backward, from six to eight inches or more long, a little concave superiorly, shorter anteriorly than posteriorly, a little narrower at its extremities than in the middle, nearly vertical, or directed a little obliquely downward and forward. *External surface.*—The anterior side is covered superiorly by the peritoneum in a small part of its extent, contiguous and united inferiorly to the bladder and urinary canal. The posterior side is also covered by the peritoneum superiorly, and rests inferiorly on the rectum, to which it adheres by cellular tissue. *Internal surface.*—The parietes of the cavity of the vagina are constantly lubricated by a more or less dense mucus, and are habitually in contact. The anterior and posterior walls each present a narrow longitudinal crest, which is more apparent anteriorly than posteriorly. It presents numerous transverse wrinkles, which are more marked nearer the vulva than the uterus. *Superior extremity.*—This is fixed around the upper part of the neck of the uterus. *Organization.*—The vagina is formed of a cellulo-vascular membrane, of a reddish colour, of a spongy erectile tissue, of a mucous membrane, a constrictor muscle already described, and many vessels and nerves. *Mucous membrane.*—It is continuous with that of the vulva; it is red and vermilion below, whitish or grayish above; it forms the wrinkles in the cavity of the vagina, and presents a great number of pores, which are the

orifices of its mucous follicles, or of its lacunæ. *Spongy erectile tissue*.—It has a grayish colour, a dense structure, and forms around the lower part of the vagina a layer about an inch broad and two or three lines thick. The artery of the vagina comes from the hypogastric, its nerves from the sciatic plexus.

#### UTERUS.

*Situation*.—In the middle of the cavity of the pelvis, between the bladder and rectum, above the vagina, and beneath the convolutions of the small intestines. *Form*.—An irregularly triangular, symmetrical, and hollow viscus, flattened from before backward, directed nearly vertically, an inch thick, and about two inches broad in its most elevated portion, but narrow and elongated inferiorly. It is divided into a body, neck, and cavity. Its *body* is nearly two inches long; its anterior and posterior surfaces are convex, covered by the peritoneum, and contiguous, the former with the bladder, the latter with the rectum. Its lateral borders are convex, directed downward and inward, and correspond to the interval of the two folds of the broad ligaments. Its superior border is rounded, transverse, a little convex, and covered by the peritoneum. In uniting with the lateral borders it forms two slightly prominent angles, at the middle part of which the Fallopian tubes terminate, above the insertion of the ligament of the ovary, which is posteriorly, and of that of the round ligament, which is anteriorly. The *neck*.—This is compressed from before backward; it is cylindrical, swelling slightly at its middle portion, and from ten to twelve lines long; its superior part is continuous with the body of the uterus, and is embraced by the vagina; the inferior forms a prominence in the bottom of the vagina, and is termed, from its form, the *os tinæ*. It presents at its summit a transverse opening, leading into the uterine cavity, bounded by two smooth and rounded lips, an anterior and a pos-

terior. The *cavity* is extremely small, occupying the body and neck of the organ; the portion of this cavity which belongs to the body is triangular, its superior angles presenting the extremely small orifices of the Fallopian tubes; that part corresponding to the neck is nearly cylindrical. *Organization*.—The uterus is composed of a serous and a mucous membrane, a parenchyma or special tissue, vessels, and nerves. The serous membrane is formed by the peritoneum; it envelopes the uterus, to which it adheres along its upper edge; but on its two faces it is separated from its tissue by many vessels and a layer of cellular tissue. The mucous membrane is continuous with that of the vagina; it is white, slightly rosy, intimately attached to the tissue of the uterus, covered by a great number of very fine villi, and extends into the Fallopian tubes. It presents the orifices of some mucous follicles, which are more abundant near the neck than in other parts, and have frequently, in this place, the size and form of small transparent and prominent vesicles, termed the ova of Naboth. Its proper tissue or parenchyma, lying between its serous and mucous membranes, is of a grayish-white colour, of a dense and elastic structure, from five to six lines in thickness, and formed of fibres, the disposition of which is as yet unknown. The arteries of the uterus come from the spermatic and hypogastric. Its veins follow the same course, and form in its parietes cavities which enlarge during pregnancy, and are called uterine sinuses. Its nerves come from the sciatic and hypogastric plexuses.

#### BROAD LIGAMENTS.

These are two folds of the peritoneum, situated in the cavity of the pelvis, forming, with the uterus and vagina, a transverse septum, which divides this cavity into two parts; they are continuous on the inside with the peritoneum which covers the uterus; on the outside with that which covers the sides of the pelvis. They are formed by two folds, between which

we find superiorly the Fallopian tubes, which occupy the free borders of these folds; downward and forward is the round ligament; downward and backward the ovary.

#### ROUND LIGAMENTS.

These are white, dense, flattened cords, narrower in the middle than at their extremities; formed by longitudinal fibres, which appear to be condensed cellular tissue; they arise from the supero-anterior lateral parts of the uterus, traverse the inguinal ring with the vessels which they contain, and which ramify in the cellular tissue of the groin and great labia, and terminate by expanding in the cellular tissue of the buttocks, mons Veneris, and external labia.

#### FALLOPIAN TUBES.

*Situation.*—In the cavity of the pelvis, along the upper edge of the broad ligament, and between the folds which form it. *Extent.*—From the upper angles of the cavity of the uterus as far as the sides of the upper part of the cavity of the pelvis; their internal extremity is fixed to the uterus; their external is free and floating, and termed the fimbriated portion. The cavity of these tubes commences at the upper angle of the cavity of the uterus; during the first part of its course it is capillary, but afterward dilates and opens on the surface of the fimbriated portion, the only example of the communication of the serous and mucous membranes. *Organization.*—These tubes are formed externally by a very thin layer of spongy and erectile tissue, and internally by a soft, reddish, and extremely thin mucous membrane.

#### OVARIES.

*Situation.*—In the thickness of the broad ligament. *Form.*—Ovoid, smaller than the testicles, compressed from before backward, and wrinkled on their surface; their external extremity gives attachment to one of



the slips of the tube ; the internal extremity is inserted into the uterus by a small filamentous cord about an inch and a half long, termed the ligament of the ovary. *Organization.*—They are formed exteriorly by a dense cellular envelope, from which numerous prolongations pass into the proper tissue of these organs ; their parenchyma is soft and spongy, and appears composed of cellular and vascular lobules, in the middle of which we observe small transparent vesicles, generally from fifteen to twenty in number, the size of a grain of millet, formed by a very thin pellicle, and containing a viscid reddish or yellowish liquid.

#### MAMMÆ.

They are situated on the lateral and anterior parts of the chest, between the axilla and sternum ; they are very small in the male and in young girls, and in the adult female they have the form of two hard and firm hemispherical eminences ; in the centre of each we observe a circle of a rosy colour, termed the *areola*, on which the skin is delicate, and but slightly wrinkled ; in the middle of this areola arises the nipple, a conoid eminence, of a rosy colour, and presenting the orifice of the lactiferous vessels. *Organization.*—The mammæ are formed by a layer of skin, a layer of fat, a gland, vessels, and nerves. The layer of fat is very thick, and contributes much to the form and size of the bosom. The mammary gland itself is situated beneath the layer of fat and in front of the pectoralis major ; it is formed of very many lobes and lobules, united by dense cellular tissue ; each lobule is composed of rounded granulations, of a rosy colour, and of the size of a poppy-seed. These glandular grains give origin to the roots of the lactiferous vessels, which form, by their successive reunion, trunks which are larger and longer, and which collect near the centre of the gland, and terminate in sinuses placed near the base of the nipple. These sinuses, from fifteen to eighteen in number, are very short

and conical; some are narrow, others are two or three lines broad; from their summit other smaller ducts arise, which occupy the centre of the nipple, and open separately on its surface. The arteries of the mammae come from the thoracic, axillary, intercostals, and internal mammary. Their veins follow the course of the arteries; their nerves come from the intercostal nerves and brachial plexus.

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### ORDER III.

#### PRODUCT OF THE UNION OF THE SEXES.

##### FŒTUS AND ITS APPENDAGES.

THE union of the two sexes gives rise to a new being, which is termed the embryo until its organs are developed, when it is called the fœtus till the moment of birth. The fœtus, while in the uterus, is enveloped by several membranes; these are the caducal membrane, the chorion, and amnios. It is attached to the uterus by the placenta and the umbilical cord. Before describing the fœtus and the development of its different organs, we shall mention its appendages, and speak also of the umbilical vesicle and the allantois.

### ARTICLE I.

#### APPENDAGES OF THE FŒTUS.

1. *Caducal membrane.*—The caducal membrane is a clotty, soft, and spongy exudation, which forms in the uterine cavity, while the vivified ovule is developed in the ovary. It is a kind of closed pouch; at the moment when the ovum descends into the uterus, it peels off slightly this membrane, penetrates into the uterus, and becomes fixed to one of the points of its

parietes. In this state a portion of the ovum is covered by the caducal membrane, the other adheres to the uterus. In proportion as the embryo is developed, it peels off the caducal membrane, which covers the greatest part of it, without containing it in its cavity, in the same manner as the serous membranes cover the viscera. This portion of the caducal membrane is termed the reflected portion, while the expression direct caducal is applied to that part of this membrane which is attached to the inner face of the uterus. After the third month of pregnancy the two folds of this membrane begin to form adhesions, which, at the end of gestation, are so intimate that the caducal membrane seems to have but one fold.

2. *Chorion*.—This is the most external of the proper membranes of the ovum. It is thin and transparent. Its external face is uneven, filamentous, and corresponds to the caducal membrane. Its internal face is united to the amnios by a gelatinous cellular tissue.

3. *Amnios*.—A thin, transparent membrane, which forms the most internal of the two envelopes of the fœtus, which it surrounds. It is reflected on the umbilical cord, which it covers, and seems to be continuous with the skin of the abdomen in the fœtus. Its external face adheres to the chorion by means of an intermediate glairy and cellular substance. Its internal face, or its cavity, is in contact with an aqueous fluid, termed the waters of the amnios, which fills it, and in which the fœtus swims. This liquid is water containing albumen and some salts.

4. *Placenta*.—The placenta is generally inserted in the upper and posterior part of the uterus. *Form*.—It is soft, firm, rounded, flattened, and oblong. It generally measures eight inches in its greatest diameter, six in its smallest, and an inch in thickness. It presents two faces, an anterior and a fœtal. *Uterine face*.—This presents numerous rounded and irregular inequalities, termed *lobes* or *cotyledons*. It adheres to the inner face of the uterus during the early pe-

riods of pregnancy; but it is afterward separated from it by a layer similar to the caducal membrane, and bearing its name. *Fœtal face*.—This is smooth, and is covered by the chorion and amnios; near its centre, and sometimes near its edge, the umbilical cord is inserted. *Organization*.—The placenta is formed by ramifications of the umbilical vessels, which form cotyledons on the uterine face of this organ. The umbilical arteries carry the blood into the placenta. Their last extremities form plexuses, which give rise to the radicles of the umbilical vein, which brings the blood from the heart of the fœtus. Arrived at the placenta, the umbilical arteries send reciprocally a branch of communication, the only one which is remarked in their successive divisions. The same arrangement exists with the umbilical vein. The caducal membrane, which covers the uterine face of the placenta, presents numerous bloodvessels, which are prolongations of those of the uterus.

5. *Umbilical cord*.—This is a twisted cord, about eighteen inches in length in a full-grown fœtus, attached on one side to the fœtal face of the placenta, on the other to the umbilicus of the fœtus. It is formed from without inward by a sheath formed on the outside by a prolongation of the amnios, and on the inside by a continuation of the chorion; by the two umbilical arteries and vein, which, in their course, turn around each other, and give to the cord its twisted aspect; by the gelatin of Wharton, a semi-fluid gelatinous substance, which is found around the umbilical vessels. We also find in this cord the urachus, and, until the third month of pregnancy, the umbilical vesicle and the omphalo-mesenteric vessels, which will be mentioned hereafter. In the early periods of gestation the cord is large, short, and hollow at its abdominal insertion. The intestines of the fœtus also descend in its cavity at this period, but afterward gradually ascend into the abdomen.

6. *Umbilical vesicle*.—This is a kind of pouch, which is generally rounded with dense parietes containing a whitish fluid, existing commonly only in the first

months of pregnancy. It is situated in the umbilical cord, between the chorion and amnios. When at its greatest size it is three or four lines in diameter. It adheres to the small intestine by a pedicle which passes through the umbilical ring. This vesicle receives an artery and a vein, termed the omphalo-mesenteric, which come from the superior mesenteric vessels.

7. *Allantois*.—This is a thin, fragile, and transparent vesicle, situated in the placenta, near the insertion of the umbilical cord. It is still a matter of dispute with anatomists whether the urachus is hollow in its whole extent, and if it communicates with the bladder.

## ARTICLE II.

### OF THE FÆTUS.

The body of the fœtus is elongated in the early periods of life, and seems formed solely by the trunk to which the umbilical vesicle adheres. All the openings are still closed at this period. The head soon appears, and about the second month it is as large as the body. The upper limbs appear at the fifth week like small papillæ. The different portions of the limbs are developed at a later period, the fingers being first seen. Next come the lower limbs, and in the same order. Near the end of the second month we perceive the neck and some of the natural openings; these are formed at three months. At this period the coccyx, which forms by its projection a kind of tail, seems to shorten on account of the increase of the surrounding parts. The organic systems do not form at the same time; the order of their development is as follows: the vessels and nerves, the intestinal canal and skin, the organs of sense and the genital organs, the locomotive organs, and finally, the nails and hairs. *Length of the fœtus*.—At the end of the first month, one line; at the end of the second, six or seven lines; at the end of the third, from one to three inches; at the end of the fourth, four to five

inches; at the end of the fifth, eight to ten inches; at the sixth month, nine to twelve inches; at the seventh, fourteen to fifteen inches; at the eighth, sixteen to eighteen inches; at the ninth, eighteen to twenty inches. *Weight*.—When born, about seven pounds.

We shall now examine in detail the development and principal peculiarities of the organization of the different organic systems of the fœtus.

1. *Osseous system*.—The bones are soft, cartilaginous, and have no cavities until the end of the second month. Points of ossification begin to appear early in the third month. From these points proceed white and longitudinal lines in the long bones, and radiating lines in the broad bones; these lines indicate the progress of ossification, and are formed of molecules of phosphate of lime. The bones in which the first points of ossification are seen are the plates, and then the bodies of the vertebræ; next come the clavicles, the lower jaw, and, at a more advanced period, the long bones of the limbs, the flat bones, and finally, the short bones of the tarsus and carpus, which are cartilaginous in the full-grown fœtus. The ends of the long bones long remain cartilaginous. When ossified, they continue until an advanced period separated from the body of the bone by a cartilage, and form *epiphyses*. *Development of the teeth*.—About the middle of the third month small sacs or follicles appear in the jaws; they are formed by two membranes, and contain a small drop of fluid. Above each sac a pulpy papilla, termed the germe or pulp, soon develops itself, and receives many nervous and vascular twigs. The tip of the papilla takes the form of the crown of the tooth which is to come, and about the middle of the fifth month the entire papilla secretes the same substance of the tooth, the crown first, and then the root. The tooth takes exactly the form of the corresponding papilla, and is moulded on it. The enamel, as fast as it forms, is gradually deposited on the outer face of the osseous substance. The tooth distends its follicle and the

gum, and finally pierces the latter, and becomes visible on the alvcolar edge.

2. *Muscular and fibrous system.*—In the early periods of fœtal existence the muscles and tendons are not distinct, and appear in the form of a homogeneous and mucous mass. The muscular fibres begin to appear at the third or fourth month. The fibrous system is at first soft and gelatinous; it does not acquire its proper characters till at the end of pregnancy.

3. *Nervous system.*—This system is one of the earliest developed. The spinal marrow is first seen; next the cerebrum, and then the spinal and cerebral nerves. The gray substance forms before the white substance. In the early periods, the spinal marrow occupies the whole extent of the vertebral canal, and presents posteriorly a longitudinal groove; the cerebrum, which appears early, has as yet no circumvolutions; the hemispheres are small, and do not extend above the cerebellum. The corpus callosum and the fornix are the last parts of the cerebellum developed. The cerebellum appears at a later period.

4. *Sanguineous system.*—In the fourth week the auricles of the heart are not separated; the two ventricles form but one cavity, which gives origin to the aorta. The pulmonary artery does not yet exist. These parts resemble but slightly what they afterward become. In the full-grown fœtus the umbilical vein, after arising from the placenta and following the umbilical cord, passes through the umbilicus of the fœtus, and proceeds along the anterior wall of the abdomen to the longitudinal fissure of the liver. It then divides into two branches; one joins the vena porta, and ramifies in the liver; the other follows the primitive direction of the vein, and, under the name of venous canal, goes to the inferior vena cava. The two auricles of the heart communicate by the foramen of Botal. The arrangement of the Eustachian valve allows the blood to pass from the inferior vena cava to the left auricle, and that of the superior cava to the right ventricle. The pulmonary artery gives two small branches to the lungs, and terminates in the



aorta by a large trunk termed the arterial canal. The aorta, after giving off its three ascending branches, unites to the arterial canal to form with it the descending aorta. Of the two arteries formed by the bifurcation of the primitive iliac artery, the external iliac is the smaller. The hypogastric, which forms the continuation of the trunk, is the larger. After giving off its different branches, the hypogastric artery ascends on the sides of the bladder, as the umbilical artery, and leaves the umbilicus with the artery of the opposite side. The two umbilical arteries ascend along the umbilical cord and ramify in the placenta, where their final twigs are continuous with the radicles of the umbilical vein.

5. *Lymphatic system*.—But little is known of the development of this system.

6. *External sensitive apparatus*.—At the end of the fourth week of pregnancy the eye appears as a very large black point. Until the seventh month, at which period the pupil forms, the opening of the iris is closed by the pupillary membrane. This membrane is thin, firm, vascular, and is formed of two layers; the anterior is the continuation of the membrane of the aqueous humour, and the posterior is peculiar to the pupillary membrane. The vessels of this membrane are radiated like those of the iris, which gives it off. After the seventh month it breaks; its sections are gradually absorbed.

*Ear*.—The orifice of the auditory passage does not appear until the end of the second month. The pavilion of the ear forms very slowly, and begins by a small purse. The auditory passage is very short, which brings the membrane of the tympanum very near the external ear. The cavity of the tympanum is very small; the mastoid cells are deficient, and, with the mastoid process, are not developed till after birth; the bones of the ear are cartilaginous till the seventh month, and then ossify gradually. The petrous process begins to ossify at the end of the third month.

*Nose and nasal fossæ*.—The nostrils do not appear till the end of the second month; the nose continues

small till the end of fœtal existence. The nasal fossæ are very small, and communicate freely with the mouth till the eighth week.

*Skin.*—It appears from the third month. It is then thin, transparent, and resembles a mucous membrane; it is destitute of epidermis, which does not appear till the end of the fourth month. The hairs and the nails are not seen till four and a half or five months. The skin is then covered with down, which disappears at the end of pregnancy, or shortly after birth. The subcutaneous cellular tissue of the fœtus is transparent, and filled with serum in the early periods of fœtal existence.

7. *Digestive apparatus.*—In the early periods the mouth seems closed by a mucous membrane. At the second or third month it opens, and the lips begin to be developed; the superior by the elongation of three papillæ or mammillary eminences, and the inferior by that of two other papillæ. About the same period are formed the palatine arch and the velum palati, which separate the mouth from the nasal fossæ, which cavities were previously united. The rudiments of the stomach and intestines appear in the earliest periods of uterine existence. The first of these organs is then small. A great part of the intestinal canal is situated at this period out of the abdomen, in the umbilical cord, which is hollow at its fœtal extremity. The intestines then receive the insertion of the pedicle of the umbilical vesicle: near the middle of the third month the intestine is withdrawn entirely into the abdomen. The intestines are at first very short and straight, but gradually lengthen and form their circumvolutions; at the same period the stomach dilates and lengthens. The cœcum and vermiform appendix are very much developed in the fœtus. The large intestine is at first cylindrical; its prominences form about the sixth month. After the first week the liver is so large that it nearly fills the cavity of the abdomen. It remains very large till birth; its volume, however, is inversely as the age of the fœtus. In the early periods the

gall-bladder is very small, the pancreas is much developed. The spleen does not appear till the second month.

8. *Respiratory apparatus*.—The lungs do not appear till the end of the second month. They are then extremely small, and afterward are developed gradually. They are redder before birth than they are after the fœtus has breathed; they are compact, have no crepitation, and sink in water. The *larynx* is very small in the fœtus. The *thyroid* gland is more developed than in the adult. A special organ, the *thymus* gland, exists in the fœtus and in young children; this has been described already.

9. *Urinary organs*.—The *kidneys* in the fœtus are very large, lobulated externally. The *renal capsules* are very large, and, until the third month, greater than the kidneys; they then become much smaller. After birth they waste. The *bladder* terminates superiorly in a cone, and is continuous in this direction with the urachus, a canal which in the male is hollow to the umbilicus, and which is obliterated at the period of birth.

10. *Genital organs*.—After the third month we find these organs in the following state: The *ovaries* are situated below the kidneys, and are very large; they do not descend into the pelvis until late. The tubes are also very large, and are uninterruptedly continuous with the angles of the uterus. The vagina is very long. Its cavity, as also that of the uterus, presents anteriorly a prominent line. The hymen begins to appear. The clitoris is very much developed. The testicles are very large, and are situated in the abdomen below the kidneys. The vas deferens descends directly into the lower part of the pelvis. The lower extremity of the epididymis and testicle is continuous with the gubernaculum testis, a cylindrical, canaliculated cord, which seems to terminate near the centre of the crural arch, and passes for a prolongation of the fascia superficialis of the abdomen. At six months the testicles begin to descend. At eight months they traverse the inguinal canal; at

nine months they have descended into the scrotum. In this course they bring with them, 1st, Several fibrous layers from around the inguinal ring; 2d, The lower edge of the obliquus internus muscle, which gives them a muscular envelope, termed the cremaster; 3d, A portion of peritoneum, which composes the vaginal tunic, the cavity of which communicates at this time by the inguinal canal with the peritoneal cavity. This communication disappears at birth. The mammæ remain rudimentary in the two sexes till puberty, when they are considerably developed in females.

THE END.

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